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VIEWS, NEWS AND INTERVIEWS.

A piece of mica was recently cut near Lincolnton, N. C., which measured 9½x16 inches.

There would not appear to be much in common between electricity and Ibsen at first sight, barring the utter inexplicability of the two, and the risk (if one is thin-skinned) of being shocked. Yet I noticed last Friday night at the Vaudeville, in my efforts to penetrate the gist of the "New Humor," that both have a very similar phrase to signify insanity. When the American street boy desires to insult the intellect of his enemy he says, "Ga'rn, yer trolley's off!" and when any member of the crazy community wishes to signify that his normal condition is about to assert itself, he exclaims, "Oh, God, my troll is off!" or words to that effect.—"*Meteor*" *in London Lightning.*

One thousand eight hundred and fifty cities and towns in this country are equipped with electric lights.

An incident is related of a New York business man telegraphing not long ago to a poultry raiser in Illinois requesting him to repair at once to the Chicago office of the long distance telephone, as he wanted to talk to him. The request was granted and the poultry raiser for one-half hour was concealed in the telephone booth. When he emerged he exclaimed: "Great Scott! I've sold a hundred thousand chickens." The charge for the use of the long distance line was $50, and the probable value of the business transacted at so slight comparative cost could not have been less than $20,000.

The latest improvement in prison construction calls for cells built of iron or steel pipes which intercommunicate, so that water or any other fluid may be kept under pressure in them. Should any attempt be made to break in or out of such a cell, the smallest puncture in a pipe will cause a leak which would give instant notice through the reduction of pressure which actuates a system of electric alarms.

The bill for an electric railway between Clapham Junction and Paddington has been rejected, owing to the opposition of the authorities of the science schools at South Kensington, London. It was asserted, and the assertion was supported by all the weight of Lord Kelvin's great authority, that the working of the line would seriously interfere with a large proportion of the valuable research work now carried on at these institutions.

A petition has been issued by the American Federation of Labor, addressed to both branches of the national legislature, requesting that a law be passed establishing a government telegraph and telephone system. Copies of the petition have been sent for signatures to all trade and labor organizations in all the large cities, and the petition is to be presented early in November.

The Edison Mutual Union Telegraph Company, with headquarters at Ft. Wayne, Ind., has been absorbed by the Western Union, and the old directory resigned and was succeeded by representatives of the Western Union, with Colonel Clowry, general superintendent of the purchasing company, as president. The Edison was organized in 1882 by George W. Beers, and it had 550 miles of line, extending from Edison, Mich., to Middletown, O., Van Wert and Ft. Wayne. The original stock was $50,000, but only $29,000 was issued. The Edison operated at Ft. Wayne in connection with the Postal Company, and its absorption by the Western Union leaves the Postal Company without a Ft. Wayne office when the present lease expires.

Burglars broke into the Western Union Telegraph office at Hoosic Falls, N. Y., last week. They got $17 in money and $90,000 worth of mortgages, bonds, etc., belonging to the Permanent Savings and Loan Association.

DR. LUDWIG K. BÖHM.

The Trans-African Telegraph.

The business partner of one of the directors of the company formed to build the telegraph line from the Cape to Cairo has given a *Pall Mall Gazette* reporter some interesting information. Capital has been subscribed to the extent of £140,000, which is considered sufficient to carry the line as far as Uganda. The materials are now being ordered in London, and will be shipped shortly. The poles are to be of iron of light construction, in order to outmanœuvre the white ants, who would eat away wooden poles. From Fort Salisbury the line is to be carried to Tete, on the Zambesi, and from thence to Blantyrie. There Consul Johnston will report the result of his surveys as to the best manner of proceeding on to Uganda, and the constructing party will have to come to terms with the natives and Arabs by subsidizing the chiefs and others of influence. There will be nothing in the way of impenetrable undergrowths or rank vegetation to contend with, as the line will avoid the low country and keep to the high plateau the entire distance. There are two alternative routes for the conveyance of the materials. There is good transport from the Transvaal to Fort Salisbury, or a shorter route would be adopted, if materials were shipped direct to Beira, carried along the railway now being built as far as it extends, and then conveyed the rest of the distance by ox-wagons. The scheme is being pushed forward with great activity now.

Dr. Ludwig K. Böhm.

On the sixteenth day of June, 1859, in the quiet little town of Lauscha, a picturesque spot in the Thuringia mountains in Central Germany, Ludwig K. Böhm, destined to play a part in the progress and invention of the incandescent light, was born.

His father, Joseph Böhm, who was commander of the revolutionists in his native city, and who was afterwards a revolutionist member of the Diet, gave this son all the educational advantages that he could afford, and in 1877 he was put into the laboratory of the celebrated Dr. H. Geissler, in Bonn, on the Rhine. Here, in the roles of pupil and afterwards assistant of this pioneer in vacuum tubes, he laid the foundation of his knowledge and skill in experimental physics, electricity and chemistry.

He became thoroughly conversant with the many details concerning the introduction of electric currents into rarefied gases, and under the supervision of Geissler he made hundreds of experiments with radiometers, etc. He became wonderfully skillful in the art of glass blowing, and it is possible that at the present day there are very few expert glass blowers in this country who can equal him.

In August, 1879, he became an assistant to Thomas A. Edison in the historical laboratory at Menlo Park, N. J. He designed there numerous mercurial air pumps, and made, under Edison's supervision, the experiments with platinum spirals, carbon spirals and card board carbons in vacuo.

The incandescent lamps on exhibition at Menlo Park, in December, 1879, and afterwards, were made by Dr. Böhm. These lamps were those, it might be stated, about which the New York *Herald* had a sensational article in its issue of December 21, 1879.

In the latter part of the year 1880 he became one of the electricians of the United States Electric Lighting Company and assistant of Hiram Maxim, later known as the machine gun inventor. While in the service of this company he took out many patents, among the most important of which may be mentioned the patent for the first apparatus of its kind for the preparation of carbon filaments, better known as the treating apparatus.

In the summer of 1881 he became electrician of the American Electric Light Company, which company combined later with the Sawyer-Man Company to form the Consolidated Electric Company. Here it was that he invented a separable lamp with a ground glass stopper. One of the patents which he took out at this time and that may be of interest to scientists, was one wherein is described a stopper lamp which was not sealed off by fusion, but was closed by mechanically turning the stopper through 180 degrees. Then it was that he took out a number of patents on air pumps.

In 1882 he returned to Germany and com-

pleted a five years' course of study in different universities under celebrated professors, and in 1886 he received his degree of Ph. D. and a diploma of the Royal Bavarian School of Industries in Munich.

We find him back in America in the year 1887; later he took charge of the chemical department and was chemist for the American Ultramarine and Globe Aniline Works, and in 1888 he made some original researches on fossil rosins for the Dawson-Valentine Company.

He was next connected with the Thomson-Houston Electric Company, and experimented on different kinds of filaments. He patented a filament composed of a mixture of carbon and calcium and magnesium oxides.

Since this time he has had an office in this city as a consulting electrical and chemical expert. His contributions to electrical and chemical literature have always been the result of hard and well-earned experience, and have been read with much profit by the members of the electrical and chemical fraternities.

His recent connection with the historical Goebel case has brought him rather prominently before the public, his testimony being particularly noticed by Judge Colt in his decision. In the Columbia suit now on hand in St. Louis, his affidavits on certain points are thorough and concise, and clearly show how intimate he is with the subjects of which he treats.

His work has been mainly in the line of electric lighting, and his numerous patents, now owned by the large electrical companies, testify to his ability as an inventor.

J. A. M.

LITERARY.

"Manual of Guard Duty, United States Army," has been received from the *Army and Navy Journal*.

The Department of Electrical Engineering, University of Minnesota, has sent to us the "U. of M. Alumni Record" for 1893.

"Souvenir of the Dedicatory Ceremonies of the New York State Building, at Jackson Park, Chicago, Ill., October 22, 1892," has been received.

A copy of the second edition of "Die Elektrischen Leitungen und ihre Anlage Für Alle Zwecke der Praxis," by J. Zacharias, has been received from the publisher, A. Hartleben, Vienna.

We have received a copy of the *Postal Telegraph*, successor to the *Electrical Message*, edited by J. Frank Howell. It is a well printed monthly and contains much of interest and value to telegraphers.

"The Electric Railway in Theory and Practice," by O. T. Crosby and Dr. Louis Bell. Second edition enlarged and revised. New York, The W. J. Johnston Company, limited; 416 pages, 182 illustrations; price, $2.50. Supplied by the ELECTRICAL REVIEW, 13 Park Row, New York.

In the second edition of Crosby & Bell, a great part of Chapter I has been re-written, and minor corrections and additions made in the other chapters. Two appendices have been added, "Motors with Bevel Gear and Series-Multiple Control of Motors," and "Method of Measuring Insulation Resistance of Overhead Lines." Eight pages of forms have been added to Appendix D, and the index has been carefully revised and considerably extended by additions from the index notes of a well known street railway engineer.

It may be of interest to know that a French translation of the book is now under way, and the following extracts from foreign reviews show how favorably the work has been received abroad:

"The work is one of those that mark an era and remain. It is the first work on electric traction, and while it will undoubtedly be followed by others, it will surely remain the best guide for those occupied with this important subject."—*La Lumiere Electrique.*

"'The Electric Railway in Theory and Practice' is a well written compendious text-book."—*London Electrician.*

"The appearance of this work can be hailed with joy in electrotechnic circles, especially as it thoroughly fulfills all that can be asked of it on the part of the practical electrical engineer."—*Elektrotechnische Zeitschrift.*

Mental Anguish is Not a Basis for Damages.

Judge Taft, of Toledo, O., has rendered a decision on demurrer in the case of Henry J. Kester against the Western Union Telegraph Company, in an action for damages for the negligence of the telegraph company in transmitting Kester this message:

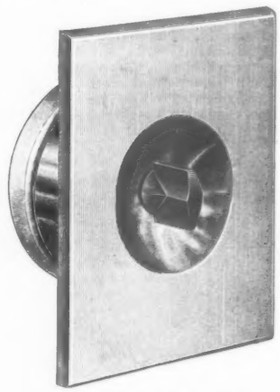
"Father dead. Send word to Brinkman, Funeral Wednesday, 11 A. M. J. F. Kester."

This message was delayed four days, and the plaintiff was thus prevented from attending his father's funeral. The question as presented is whether mental anguish alone constitutes any basis for damages in such a case. Authorities conflict; and in the decision the judge says:

"We think such decisions are a departure from the sound and safe principles of the common law. The difficulty of estimating a pecuniary compensation for mental anguish is itself a sufficient reason for the common law rule in preventing a recovery for mental anguish as actions for simple negligence or breach of contract. The amount of litigation which would grow out of the adoption of such a rule would be intolerable." The demurrer was sustained.

The Hart Flush Switch.

The Hart flush switch, illustrated herewith, manufactured by the Hart & Hegeman Manufacturing Company, Hartford, Conn., and which is now ready for the market, has several points of merit. The general appearance of the switch, when placed in position, is neat and attractive. It is finished in any of the standard finishes, and special finishes are furnished when desired.



THE HART FLUSH SWITCH.

The switch proper is attached by two screws to a cast brass plate, from which it is readily detached for wiring, and is protected from injury and dust by a surrounding brass shell attached to the back of the cast plate. The cast plate with switch attached is screwed to the wall, and a finished cover of heavy sheet metal with flanged edges is put on over the cast plate and held in position by the switch handle. No screw heads show on the surface of the finished cover, thus avoiding the necessity of special screws to match the finish of the cover. An assortment of finished head screws of different lengths to suit different requirements is unnecessary, for, as they are not exposed, common flat head screws of convenient length may be used for holding the plate to the wall. The flush plate illustrated is adapted for use with the regular Hart snap switch of the following sizes: Five and 10 ampere single pole, 10 ampere double pole and 10 ampere three-way.

A Gentle Intimation.

A telegraph operator at Sedro, in the Evergreen State, who has grown very tired of answering foolish questions, has posted the following, written on a typewriter, just outside his office window: "Notice—Yes, your message will go at once. It will be sent immediately. In fact, we send all messages as soon as we can. We know you wish your telegram sent at once, otherwise you would write. Special Notice—The Supreme Being only can inform you when you will receive a reply."—*Northwest Magazine.*

The Present and Future Competition Between Gas and Electricity.

READ BEFORE THE OHIO GAS LIGHT ASSOCIATION, BY JOSEPH GWYNN.

The above subject was assigned me by the Executive Committee of the Ohio Gas Light Association, and at the urgent request of our worthy secretary, I consented against my own judgment to prepare a paper on the subject. My reasons for objecting were that I did not consider it a proper subject to come before a strictly gas association, and last, but not least, my grave doubts as to my ability to add anything to what has already been written in papers read before this association some years ago. I feel confident that the subject as treated will not please what is termed strictly a gas man, as his whole heart, soul and energy, if he is a wide awake gas manager, are bent upon his gas business; and as most of you are aware, everything in the illuminating line is inferior, unreliable and impracticable as compared with gas, that is, looking at it from his stand point. But none the less, electricity is in our midst and with its rapid strides is advancing with unparalleled rapidity in all directions. Never in the history of the civilized world has any one invention or discovery made the rapid strides and advancement that has electricity. It has been, and is being, daily pushed by unlimited capital and energy. As I stated at our Dayton meeting several years ago, electricity has come to stay, and my advice to all live gas managers is not to follow in the footsteps of Rip Van Winkle, but to wake up and take hold at the helm and be at your posts ready to meet all emergencies as they come, and be in shape to give the public whatever kind of light they demand. That electricity is a full fledged competitor of gas, in all that the word implies, I think there can be no doubt. It has, practically speaking, an unlimited field to fill, and more opportunity for rapid strides and advancements than has gas; and, while it has some disadvantages to gas, looking at it from an illuminating standpoint, yet on the other hand, it has some advantages over gas.

In order to get at the inwardness of both branches of the industries, and to treat them fairly from an unbiased standpoint and produce a paper based on actual facts and figures, and not one written from my own views on the subject, I communicated with upwards of 200 gas and electric companies in different parts of the United States, in order to obtain as reliable data as possible on the subject to be treated. In order to give each one opportunity to consider the subject for himself and to rely on his own judgment as to the best course to pursue in the future, I append a few figures in order to fully show the advancement of both branches of the business. To show the rapid advancement of one branch of the electric business, which is arc lighting, I append the following figures, showing the growth of the carbon business. Upon the introduction of the arc lighting business from the year 1879 to the year 1881, only a small amount of carbons were manufactured, and from what data I can obtain the total sales of carbons would not exceed one million per annum, with price ranging from $120 to $150 per thousand. From 1881 to January 1, 1892, the amount of carbons manufactured and sold in the United States has gradually increased until to-day there are upwards of 145,000,000 of carbons being manufactured and sold annually, with price ranging from $9 to $10 per thousand. From the above figures, it will be seen that the arc lighting business has shown an average advancement of over 12 per cent. per annum for the past 12 years. While the arc lighting business has shown a rapid advancement for mainly public lighting, what effect do we find this has had upon public lighting by gas companies? To-day, out of over 928 gas companies in the United States, we find of that number only 435 have contracts for street lighting, and 493 have lost the street lighting business entirely, which has been displaced by arc and some few incandescent lights; while, on the other hand, a great many of the gas companies who still do street lighting do only a limited business in this line, as street lighting by gas is being gradually displaced by electricity and will eventually be a thing of the past. Let us again consider the two great competitors from a commercial lighting standpoint, and what are the results? The aggregate gain in output of 27 gas companies for the year 1891 is 6.56 per cent., and for the year 1892, 6.61 per cent., or a net gain of 13.61 per cent. for the output of 1892 over that of 1890. For comparison, I will now show the aggregate gain of the commercial electric lighting business. In 1891, the aggregate number of incandescent lamps then installed by 14 electric companies was 16,475, and in 1892 the aggregate number of lamps then installed had reached 33,238, showing a net gain of over 100 per cent. in the past year. From the above figures, it will be plainly seen that the net increase of commercial incandescent lighting for the past year over gas is 93 per cent. In addition to the incandescent lighting business of the above electric companies, I find that, in 1890, they had then installed 1,047 commercial arc lights, and, in 1891, they had increased to 1,149, and, in 1892, to a total of 1,620 lights, showing a net gain in the past two years of over 54 per cent.

Again, let us look at the lighting question. It has been claimed by most gas managers that electricity could not compete against gas for day lighting, as the business was not sufficient to justfy an electric company to operate day circuits only in large cities. In this respect, I wish to say they have been mistaken, for I find that quite a number of electric companies in cities of 20,000 population and under are operating day circuits or, in other words, are operating their plant for the full 24 hours. I am asked how they can afford to operate a day circuit without continual loss. I wish to reply to this question by saying that, in addition to what lights are required, the constant demand for ventilating fan motors, from which a good revenue is derived, enables an electric company to operate a day circuit at a small profit. To give you an idea of the growth and prosperity of the ventilating fan motor business, which is being rapidly introduced by electric companies, I append a few figures obtained from the manufacturers as to the sale of fan motors for the years 1891 and 1892. In 1891 the sale of fan motors by four of the principal electric companies was 2,012. In 1892 the sale of fan motors by the same companies was 5,093, and the companies above referred to stated in their report to me that from the present outlook the sales of fan motors for the year 1893 will be 50 per cent. greater than for the previous year. In order to further enlighten you on the possibilities of electric companies operating day circuits, I wish to call your attention to the following figures showing the enormous increase in the sales of motors used for isolated purposes and independent of street car use. In the year 1889, the sales were, practically speaking, nothing, as the reports obtained show an aggregate sale of 175 horse-power. In 1890, the aggregate sales of motors of five of the principal electric companies show 6,584 horse-power. In 1891, the aggregate sales of motors by six of the principal electric companies were 9,657 horse-power, and for the year 1892, the aggregate sales of seven of the principal electric companies were 19,216 horse-power, or, in other words, the total sales of motors for the past three years by seven of the leading electric companies show an aggregate of 35,457 horse-power. This branch of the business, if you will stop to think, comes in competition with the gas engine business, and while I have no figures to show the aggregate horse-power of gas engines sold for the same period, yet, at the same time, I venture the assertion that 25 per cent. of the sales of motors would be a fair estimate for the sales of gas engines. This branch of the motor business, looking at it from an electric standpoint, is not as easy to handle, nor possibly not as profitable, as is the gas engine business to gas companies. While the gas company can furnish the gas required for gas engines through the same line that is used for illuminating purposes and without increased expense, it is impossible for electric companies to furnish current for motor use from the same circuit used for lighting. As I stated above, fan motors can be operated on the electric lighting circuits, but when an electric company undertakes to operate anything larger than fan motors from a lighting circuit, the continual stopping and starting of the motor will cause a variance in the lights.

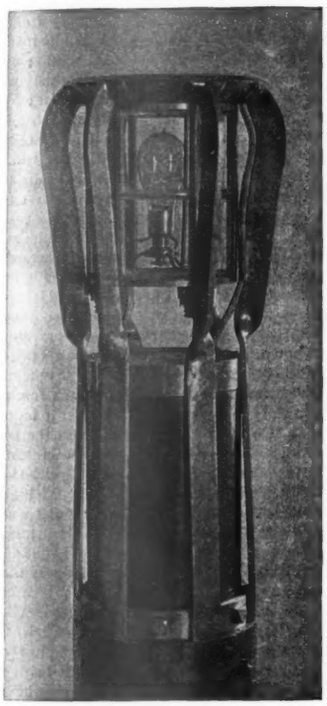
There is no doubt but that electricity has made rapid advancement over gas in the past, and while it will continue to advance possibly more rapidly then will gas, yet, at the same time, in the future, the advancement will be somewhat checked as the novelty has worn off. Yet, on the other hand, the continued improvements, which are many and great in electrical appliances, will continue to make the electric business more simple and reliable, and will still hasten its progress rapidly on for some years to come. In conclusion, I wish to make mention of a few facts that may be of interest to gas companies. My advice to all is to stand firm and push your business with all the vitality you have. Strive to make as good quality of gas as is possible at a minimum cost, and sell at the lowest price possible to give a fair return on the capital invested. Again, let me urge upon you the necessity of pushing your gas heating and cooking business as rapidly as possible, as this is an almost unlimited field for gas companies, and one that is not likely to be disturbed in the near future by your co-competitor, the electric light company.

Electric Buoys for the World's Fair.

A NOVEL AND INTERESTING SYSTEM, THE LARGEST AND MOST COMPLETE IN THE WORLD.

In the ELECTRICAL REVIEW for March 12, 1892, was a very interesting illustrated description of the electrical buoys used to mark the "swash channel" at Sandy Hook. This was and is the only system of electric buoys in use in the world. Within the last few weeks, however, a system of greater magnitude and electrical originality has been devised for use in Lake Michigan during the World's Fair, work upon which has already been commenced. This system, which involves many novel features, will be one of the greatest electrical attractions at the Fair. Foreign naval officers have been favorably impressed with the electrical buoys at Sandy Hook, and will probably be still more interested in the World's Fair buoys.

The peculiar situation of the World's Fair grounds with relation to the city of Chicago calls for unusual transportation facilities. In order to handle the immense crowds passing to and fro between the city and Jackson Park, and to ease up the load imposed upon the railroads, the World's Fair management



ELECTRIC LIGHTED BUOY FOR THE WORLD'S FAIR.

decided to run a line of whaleback boats, which will carry passengers from opposite the Auditorium Hotel to the Casino wharf at the World's Fair grounds. It then became necessary to mark a channel for these boats. It was at first thought that spar buoys would answer the purpose; but after it was decided to keep the World's Fair open at night that plan had to be abandoned, and the only alternative left was to appeal to Commander J. J. Brice, U. S. N., in charge of the Ninth Lighthouse District, with headquarters in Chicago. Commander Brice communicated with the United States Lighthouse Board at Washington, requesting authority and permission to erect the required line of electric buoys similar to those at Sandy Hook. The Lighthouse Board communicated with Capt. W. S. Schley, U. S. N., inspector for the Third District U. S. Lighthouse Establishment, with headquarters at Tompkinsville, S. I. Finally Congress passed a bill appropriating $20,000 for the installation of the World's Fair buoys. After a conference between Captain Schley and Mr. Ira W. Henry, the electrical engineer for the Bishop Gutta Percha Company, of New York, who installed the Sandy Hook plant, it was discovered that the problems involved at Chicago would preclude the use of the Sandy Hook system, the cost of the cable alone amounting to $40,000. Mr. Henry immediately set to work and designed a new system, which is now being installed.

There will be 13 buoys located half a mile apart extending from a wharf opposite the Auditorium Hotel in the city of Chicago to the Casino wharf opposite the World's Fair grounds. The ends of this line of buoys are located about three-quarters of a mile off shore, but the middle of the line makes a wide sweep extending two miles from shore to avoid the Hyde Park shoal. The submarine cable which will furnish current is now being made by the Bishop Gutta Percha Company and will be a stranded copper conductor No. 8, B. & S. G., insulated with gutta percha, with a jute bedding and armored with iron. It will be 14 miles long.

One of the chief points of novelty about this system is the fact that the buoys will be operated in series by an alternating current of 1,460 volts. This cable, it is believed, is the longest submarine cable in the world carrying an alternating current of such pressure. The Columbian Exposition Company will furnish current at 2,000 volts. A structure will be erected at the end of the Casino wharf in the form of a lighthouse. In this structure will be located a special converter now being made by the Westinghouse Electric and Manufacturing Company, of Pittsburgh, after designs by Mr. Henry. This converter will be used to transform the current from 2,000 to 1,460 volts, the pressure required on the buoy line. Besides this special converter the lighthouse at the end of the wharf will be equipped with all necessary instruments to connect the submarine cable and the land line, together with a special Wurts non-arcing lightning arrester.

The illustration on this page shows the head of one of the buoys. It is equipped with a 100 candle-power incandescent lamp and in the head of the buoy between the two horizontal iron bars of the cage will be sunk a special series converter. The connections of the cables are carried in slots sunk in the sides of the buoy and covered with strips of wood, screwed tight.

This line of buoys will mark a "fair way lane" from Chicago to the World's Fair Grounds. Steamers will run up one side of the buoys and down the other. The average depth of water is 25 feet, as shown by recent surveys made by Captain Schley and Mr. Henry from the lighthouse boat "Dahlia." They found that the bottom of the lake at this place is composed of sand, clay and in some sections cobble stones. The system will be in operation by June 1.

Lieut.-Commander Symonds, in charge of the marine transportation of the World's Fair, is naturally very much interested in this scheme, and did everything in his power to assist Captain Schley and Mr. Henry during their recent trip to Chicago.

Great credit must be awarded to Mr. Henry for the novel design of this system of buoys, which in all probability will become historic.

TELEPHONE NOTES.

At a recent meeting of the directors of the Clark Automatic Telephone Company, of Sioux City, Ia., the following officers were chosen: President, E. W. Rice; vice-president, J. C. Lawler; treasurer, J. A. Dean; secretary and general manager, J. H. Quick; general superintendent, E. A. Clark.

The grand jury in Baltimore, last week, dismissed the case of Thomas E. McSherry, charged with violating Section 232 A, Chapter 387, of the Acts of 1892, by charging and collecting for the Chesapeake and Potomac Telephone Company more than the legal rates prescribed by law for the rental of telephones. Mr. McSherry is an agent of the Telephone Company. He was accused of charging E. B. Hunting & Company $100 yearly rental for a telephone when the lawful rental is not more than $78. The case was intended to be a test by the Telephone Protective Association.

Micro-Telephone Installations.

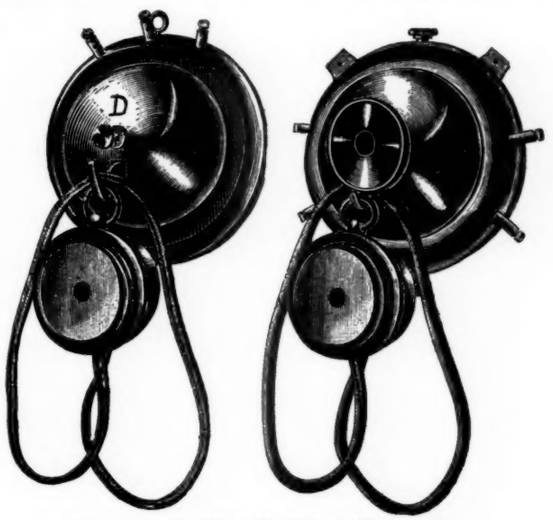
Among the host of new telephones and telephonic devices which are now flooding the market, a house telephone-set, invented by Max Sempert, of Suhl, Saxony, is interesting on account of its compactness, good workmanship and smallness.

Figs. 1 and 2 disclose the entire installation in its actual size. It will be noticed that all auxiliary apparatus, such as a commutating switch, key, bell, etc., are placed beneath the dome shaped cover D. Thus there is no need of the usual wooden enclosing box. A key projects through the center of the cover which, as a matter of

FIG. 3.—POCKET TELEPHONE.

course, serves as the bell, having a diameter of only 9 cms. The automatic switch is situated immediately beneath the key. By taking off the bell cover, the entire inside apparatus is open for inspection and repairs.

Fig. 2 shows an entire complete telephone station. The microphone as well as the induction coil are below the cover and the only change in the outward appearance of the apparatus is the addition of a mouthpiece or funnel which penetrates through the center of the bell cover. This funnel is closed at its inner end by a plug of cotton to absorb any moisture; it is stated that this simple device is most effective and that the reproduced sounds are very clear and distinct. Of course, this is not a new idea,



FIGS. 1 AND 2.—MICRO-TELEPHONE INSTALLATION.

Mr. Watson and other inventors having patented the same idea many years ago in the United States.

Fig. 3 represents a movable telephone station in its entirety and is called by the inventor a pocket telephone. In spite of its smallness it includes all necessary auxiliary apparatus and is said to work faultlessly. House and hotel telephone installations are going to be a rich field for the American inventors, and a decided advance in that branch of the business may confidently be expected at the expiration of the second Bell patent.

The Lowell Press Club and their friends had a treat last week. Mrs. Albert Barker, the English "prima donna reciter," who has created such a furore in Boston, gave a recital to them on the long distance telephone wires from Boston, arrangements being made by the telephone people so that half a dozen or more persons could hear it at the same time. The Club kept open house for the members of the fraternity.

A Novel Telephone Line Construction.

The technical staff of the Pressburg Telephone Company has sent to the *Electrotechnischer Anzeiger* a description of the line construction recently invented by Mr. Kragl (one of their members), and adopted by the local telephone company. The letter states that the Pressburg Telephone Company has met with great difficulties in the construction of telephone lines within the city, partly on account of the unfavorable condition of the principal streets and thoroughfares, and partly on account of the frequent extremely severe winters. At the original installation of the telephone exchange, the subscriber's lines were carried on poles, having a capacity of 33 conductors, but the requirements of the service rapidly outgrew the existing facilities, and thus the managing engineers were called upon to devise ways and means out of the difficulty. It was then decided to adopt the diagonal line construction, in other words, instead of building straight pole lines, a system was chosen in which certain prominent houses serve for the support of the main lines, every second one of such houses being on the opposite side of the street. Thus the line is zig-zagged, instead of being straight, requiring, it is true, a considerably larger amount of conductor. Nevertheless, it is claimed by the engineers that this apparent increase in the expense of construction is largely overbalanced by the non-use of tall and expensive cedar posts, and that many more insulators can be attached to house supports than to the cross arms of poles. As only such houses are selected as are quite prominent, the lines are free from the usual obstructions, easily inspected, handled and repaired, and do not impede street traffic. Although this new method of line construction has been freely discussed among European telephone engineers, there always seemed to prevail a vague suspicion concerning its stability under severe atmospheric conditions. However, as the last winter was the severest we have had for a long series of years, and as the average of telephone lines run on poles throughout the continent of Europe have greatly suffered from the effect of snow storms, etc., the fact that the telephone lines in Pressburg remained absolutely free, even from an accidental contact between two adjacent conductors, certainly speaks favorably for the new diagonal line construction. The technical staff of the Pressburg Company strongly recommends this kind of construction, and is of the opinion that it is a decided step in advance. In a subsequent letter they promise to give some interesting details concerning grounded telephone lines, and a full description of some special telephone devices and apparatus.—*Electrotechnischer Anzeiger.*

The officers of the Cataract Construction Company are expected to meet at Niagara Falls this week. It is thought quite likely that at this meeting the route to be chosen for laying the cables for the transmission of the electric power will be decided upon.

The Use of Ground Connections in Electric Light Installations.

At the February meeting of the French International Society of Electricians, Mr. R. V. Picon read a carefully prepared paper on the use of ground connections in electric light installations. After a few introductory remarks, Mr. Picon continued as follows:

The French government, as is well known, permits the grounding of electric light currents, but it prohibits the use of earth as the return conductor. Although the Edison Company, of Paris, grounds the conductors, and contends that by so doing a large amount of danger is avoided, it is, nevertheless, true that the use of grounds in electric light installations is strenuously objected to by a great many capable electricians. It

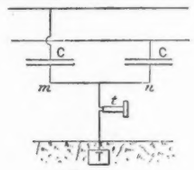


FIG. 1.

seems, therefore, of interest to examine such casualties as have been caused by accidental grounds, and to consider the question under what conditions it is useful to employ permanent grounds. Accidents may be caused by (1) heating effects, and (2) electrolytic action.

Generally speaking, accidents are caused by insulation faults, while imperfect grounds are frequently the source of electrolytic action. Indeed, the major part of accidents may be ascribed to electrolysis. It has been found that the electrolytic decomposition of salts contained in the soil does not only wear away the insulation of conductors but also quickly corrodes adjacent gas and water pipes.

Again, it may be stated that for high potential currents grounds are useful. Whenever such grounds exist, the action of high potential currents produces fire, which quickly decomposes all humidity, thus forming gaseous substances, which, in turn, cause violent explosions.

In an ordinary electric light installation, composing a dynamo and an insulated line wire, there are two neutral points which may be grounded; one of these points is the center of the dynamo, the other the middle of the line wire. It is evident, however, that it is not easy to determine this point, because, as a rule, it will be in a conductor

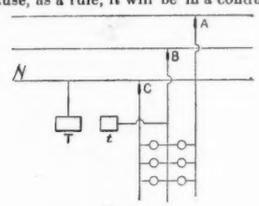


FIG. 2.

supplying a subscriber's building. In order to use the center of the dynamo, we must employ two additional brushes placed equidistant from the principal brushes. A much more practical plan consists in the interrelation of two small dynamos in series between the binding posts of the generating dynamo and to ground the junction point of the two machines, this being the neutral point. Whenever a ground happens on any part of the line, a current passes through the earth wire which might cause fire. To prevent such accidents, it is necessary to interpose a fuse in the ground conductor.

In an electric light installation constructed on the Edison three-wire plan, it is best to ground the bus wire, but such ground should be of little or no resistance. I may point out that whenever the resistance between two grounds is sufficiently high to produce a potential difference of one volt, electrolytic action is sure to set in.

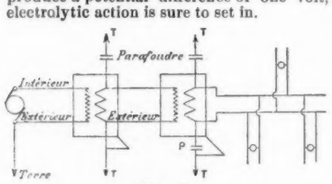


FIG. 3.

Coming now to alternating light circuits we cannot properly speak of a neutral point. My experience has taught me that grounds should be avoided, but it is advisable to employ some device which will quickly indicate the occurrence of a ground. The following arrangement works well and is self-explanatory: As long as the line is free of earth contacts the telephone remains quiescent. As soon as a ground takes place the telephone produces a loud noise, and if the ground is sufficiently pronounced the current from the condensers will ring a magneto bell.

Although I have stated that, as a rule, it is not advisable to ground alternating light systems, this does not apply to the triphased current installations. Here the junction point of the three branches is at zero potential and may be safely grounded.

If it is desired to avoid the electrolytic effects so frequently observed between accidental grounds and adjacent pipe systems, the negative conductor should be earthed, but such ground must be as perfect as possible. Do not use gas or water pipes, for it will frequently happen that the joints between the several pipes offer a high resistance to the current. Mr. Boohet has lately pointed out in what manner accidents caused by grounds may be prevented in a three conductor system.

Suppose a ground happens simultaneously on the outgoing conductor and bus wire T, the resulting current will quickly blow the fuse at B. In that case the bus wire will be at the same potential as N, resulting in the extinction of all lamps connected with N, and overheating all lamps attached to A. I call attention to a statement made by Mr. Arnoux, *i. e.*, the primary cause of the average of grounds must be absorbed to the humidity which is found to exist in all conduits of insufficient capacity. In the United States all underground electric light conductors are placed in large, capacious conduits, allowing of easy access. In France these conduits are of insufficient size, and the terra cotta pipes employed by the Edison Company are by no means to be recommended. In our large cities the soil is subjected to continuous vibrations which affect the joints of such pipes, allowing humidity to penetrate. As a consequence, white salts form at the positive conductor, while blue copper salts accumulate at the negative conductor; in fact, cases are known to me where several pounds of such salts have been taken from terra cotta conduits. The best conduits are those constructed of cement, especially when care has been taken to force in dry air from time to time.

For alternating light system operated by high potential currents, the construction adopted by the London Supply Company is by far the best.

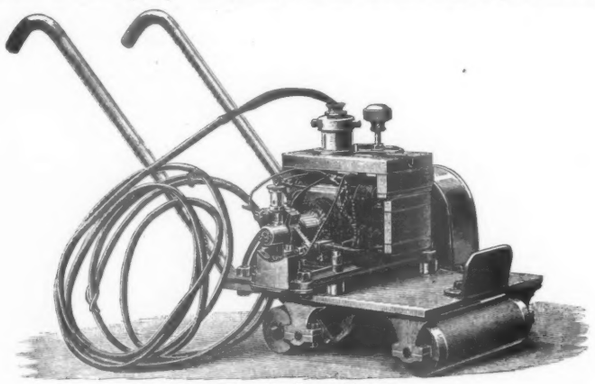
Mr. Ferranti, in his circuit carrying 10,000 volts, establishes a ground in the neighborhood of the dynamo, while in the 2,400 volts circuit an earth is formed at the binding posts of the transformer. In fact, the iron body of the transformer is connected to earth, and finally several points of the main current are indirectly grounded through lightning arresters.

At a town meeting in North Attleboro, Mass., last week, it was voted to furnish for the town an electric light plant for street and commercial lighting at a price not to exceed $50,000.

The large main driving sheave or wheel at the Brush Electric Light Works, at Niagara Falls, burst last week, scattering destruction everywhere. Fortunately there were no persons in the wheel room at the time and no lives were sacrificed. The noise of the explosion was heard for a half a mile around. Pieces of cast iron weighing from 100 to 200 pounds flew up through the roof, cutting foot beams in two. One piece drove a hole through a six-inch stone wall. The accident was due to the tremendous centrifugal motion attained by the sheave, owing to some of the mills closing down on the hydraulic race. The watchman observed the increased force, but before he could close the water gates the accident had occurred. The wheel was of cast iron; weight 25,000 pounds with 18 inch face.

An Electric Deck Planer.

The use of electricity for transmitting power has been steadily increasing during the last few years. Not only is it often found better than mechanical transmission, but in many cases it enables mechanical power to be applied to work where, without electricity, it would be quite impracticable to use anything but hand-power. One of the latest machines of the latter kind is an electric deck planer, invented and patented by Mr. Malcolm Sutherland, electrical engineer to Messrs. W. Denny & Brothers, well known shipbuilders of Dumbarton, England. The illustration, for which we are indebted to the London *Electrical Review*, shows one made by that firm, and used by them for planing the decks of the ships they build. It is so simple in construction that very little explanation is necessary. It resembles a lawn mower in form, and is handled in the same way and with as much ease. A steel base plate is mounted on rollers, and on the underside of this the revolving cutter is fixed. The electric motor is placed on top, and is geared to the cutter by means of toothed wheels. The latter is one of Rawlin's spiral cutters, and



AN ELECTRIC DECK PLANER.

revolves at a speed of 3,000 revolutions per minute, the motor having a speed of 2,000 per minute. The hind rollers which follow in the cut are fitted with eccentric journals, so that by moving a lever they can be raised or lowered and the depth of cut nicely adjusted. It does very good work, is faster than hand planing, and relieves the men of a very disagreeable job, as the planing of decks by hand involves kneeling or sitting in a very uncomfortable position. Current is supplied to the motor by means of a twin flexible lead, and the whole machine is of a very compact and portable nature.

Important German Patents.

Dr. Phil. H. Zerener, of Berlin, has sent us the following list of important German patents issued from March 9 to March 23, 1893, by the Imperial German Patent Office:

BATTERIES.

21 G. 7165. Thermo-electric battery constructed while on filling furnace; Dr. med. Paul Girand, Chantilly, Oise, Frankfort.

21 M. 9258. Immersion battery with contrivance for detaching particular electrodes without interruption of the current. Dr. Ernst Mohr, Pottschappel, Dresden.

21 P. 6122. Decomposable dry galvanic cell. Otto Pechül, Muskau.

RHEOTROPES.

21 L. 7566. Commutator to charge accumulators with reversed current. Carl Liebenow, Haspe.

PERMUTATORS.

21 H. 12494. Starting contrivance for electro motors. Gottfried Hagen, Kalk, Köln a/Rhein.

21 W. 8803. Apparatus for calling up telegraph offices and telephone stations; addition to patent No. 66353. H. Wetzer, Pfronten near Kempten, Bavaria.

4 D. 5363. Glass shade for incandescent and arc lights, also for lamps of every description. Charles Deselle, fils, Paris.

53 B. 14209. Walking stick with incandescent lamp and fuse. Otto Renkewitz, Emil Renkewitz and Richard Bayer, Berlin.

51 C. 4373. Apparatus for cancelling with movable marking wheel. Capitaine Hertling, Berlin.

General Electric Company's Transformers.

The use of the alternating system for incandescent lighting has, within the past few years, made immense strides, so much so, indeed, that it is fast advancing on the record made by the direct current system. This is, perhaps, chiefly due to the high state of perfection to which the apparatus for lighting by the alternating current has been brought by careful research and experiment, as well as to the skill displayed in installation.

Next to the generator itself, the transformer may be said to play the most important part in the system. On its efficiency depend to a great extent the profits of the station; and it is the protecting device between the station and the consumer.

Almost from the time of its introduction, the transformer has been an efficient device, but it has required years of practice to make manifest its shortcomings, and numerous experiments have been made in order to successfully overcome them. In this work the General Electric Company may be said to have done good service.

The essential characteristics of a good transformer are perfect safety, high efficiency, good regulation, small core loss and convenience of installation. In the "F" type of General Electric Company transformers, perfect safety is attained by insulating by the best mechanical means; by the use of oil as an additional insulation; by the provision of a core ground wire; by the subdivision of the primary and secondary coils, and by the absence of all fuses in the transformer case. The additional insulation given to the transformer by the use of oil renders its insulation as nearly perfect as human ingenuity can devise. For, the case being filled with a high grade of mineral oil, the coils and core are entirely immersed, with the result that should the lightning strike one of these transformers and injure the insulation in any way, the oil would immediately flow in and restore the apparatus to its original condition. These oil filled transformers have been subjected to numerous stringent tests, and it has been found necessary to increase the potential to more than 11,000 volts alternating before the insulation between the coils could be broken. After allowing the apparatus in which the insulation had just been broken by this high potential to stand a short time, the test was again applied, and not until the potential had been increased to over 5,000 volts alternating did the insulation give way the second time.

The core ground wire serves to render the transformer still more mechanically efficient, for should lightning break through the insulation of the primary coil, it is carried at once to the earth by the core wire, which should be carefully grounded. Furthermore, the primary coils are themselves subdivided. By this means, the greatest difference in potential existing between any two parts of the primary and secondary windings is only half the primary voltage, the secondary winding being the nearer to the core.

The absence of fuses in the transformer case obviates the necessity of opening the case, and eliminates whatever danger might be caused by the molten metal of the blown fuse. The fuses, in a separate box, noncombustible and waterproof, together with the primary switch, are placed in an easily accessible position, thus allowing of the relegation of the transformer to one free from disturbance. The fuses are covered with rubber tube, and it has been shown by actual test that where a certain potential will form and hold an arc in the open air across a space of seven inches, the use of tubing hinders the formation of an arc under the same potential, even across the small space of one and three-quarter inches. On systems using potentials of over the regular 1,040 volts, two single pole boxes are employed.

The efficiency obtained in this transformer has been shown by exhaustive tests to be as high, if not higher, than any yet obtained, and an excellent average at all

loads. It will be seen by the following table, furnished by the General Electric Company, that the larger the transformer, the greater is its efficiency:

WATT CAPACITY.	¼ LOAD.	½ LOAD.	¾ LOAD.	FULL LOAD.
600	84.1	90.95	93.	93.8
1,000	88.2	93.	94.	94.7
1,500	90.	94.	94.95	95.23
2,500	90.25	94.32	95.45	95.74
3,500	93.0	95.7	95.8	96.
4,500	93.9	96.3	96.85	96.96
7,500	92.2	95.8	96.4	96.85
15,000	91.5	95.3	96.3	96.5
30,000	93.3	95.9	96.8	97.2

Practical uniformity of potential on the secondary winding throughout the range

FIG. 1.—SMALL TRANSFORMER.

from full load to light load, is the test of regulation of a transformer, for the difference of only a few volts on the secondary winding from the normal means either unsatisfactory light, or a shortening of the life of the lamp. It is to this point that the General Electric Company has given much attention, with the result that their transformer gives no greater drop in potential than that shown in the following table:

TRANSFORMER. 52 VOLT SECONDARY. Capacity in Watts.	Drop of Potential in Volts.
600	1.09
1,000	1.21
1,500	1.95
2,500	1.43
3,500	1.5
4,500	1.5
7,500	1.6

TRANSFORMER. 104 VOLT SECONDARY. Capacity in Watts.	Drop of Potential in Volts.
15,000	3.
30,000	3.

Core loss is an element more or less present in transformers of any make, due to hysteresis, or molecular friction, due to rapid reversals of polarity, and Foucault or "eddy" currents. Its elimination is a problem which presents considerable difficulties, and, although it is almost impossible to prevent the loss entirely, yet the high efficiency of the apparatus under consideration shows that that loss is extremely small.

FIG. 2.—INTERIOR OF SMALL TRANSFORMER.

The tendency of present practice is the substitution of a few large units for a large number of small ones at points having a sufficient number of lights to warrant this step. This marks the abandonment of the idea that the transformation of a large amount of electrical energy in one large piece of apparatus is less reliable and more dangerous than that made by means of a number of smaller pieces. The excellence of construction of the larger devices has served to dispel this idea, and the larger transformer is undergoing steady and rapidly extending adoption. The larger transformers constructed by the General Electric Company are designed for a transformation of 15,000 and 30,000 watts. Their size necessitates a subdivision of winding. In

FIG. 3.—FUSE.

the 15,000 watt transformer both the secondary and the primary coils are each subdivided into two parts; in the 30,000 watt transformer the primary winding consists of three and the secondary of two separate coils. By this means satisfactory regulation is obtained. In these, as in smaller sizes of transformers, provision has been made for a perfectly free circulation of the insulating oil about the different coils. The larger sizes have no connection boards, the terminal wires being brought out at the top of the case for connection through suitable switches and fuse boxes to the primary and secondary wires.

The illustrations show the method of construction of the transformers. The laminated core is securely fastened into the iron case by means of wooden wedges, which serve as insulation between the coils and the case. The cover to the case is slightly arched and flanged in order the better to protect the interior from mechanical injury. Each transformer is subjected to an insulation test of 5,000 volts before it is allowed to leave the factory.

The advantages derivable from the use of large transformers are numerous. Small

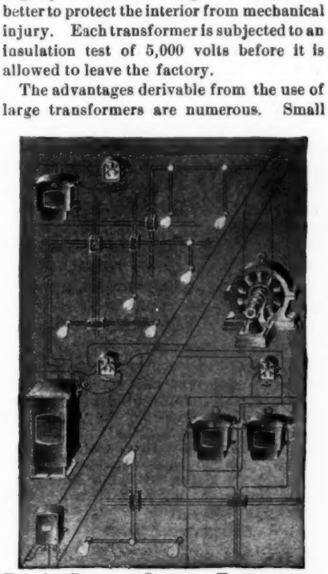


FIG. 4.—DIAGRAM SHOWING TRANSFORMER INSTALLATION.

transformers in parallel are apt, from various causes, to give trouble by unequally dividing the load between them; and the combined efficiency is always less than that of the single transformer equal to their aggregate capacities. From a large transformer a three wire system may be operated directly from its secondary terminals. But few people appreciate the advantage of using a high potential on the secondary winding, where a large number of lamps are to be installed at one point; and yet this can be shown as follows:

With 500 lights installed on several transformers in parallel, having a potential of 50 volts on their secondary wires, there is a drop of potential in the secondary system from no load to full load of about six per cent. The substitution of a large transformer, with its secondaries connected for 104 volt lamps on the three wire system, will reduce the drop in potential from six per cent. to about one-half of one per cent. This drop is far less than is necessary for satisfactory operation, and it is, therefore, possible to install the system for less than one-half the cost of wire of a system with small transformers using a 52 volt potential and six per cent. drop.

The operation of electric lights or motors at a considerable distance from the source of power has rendered necessary an even higher development of the transformer, in order that transmission of the power by electricity may be economically accomplished.

The system of long distance transmission as employed by the General Electric Company is that of using generators, which give a potential of about 1,000 volts, and large transformers adapted to raise the potential to 5,000 volts or higher. The current thus transformed is transmitted over wires, supported upon oil insulators, to the distant receiving point, and is there re-transformed to an easy operable potential.

The line insulators employed consist of a wide glass cup with an inner flange, which

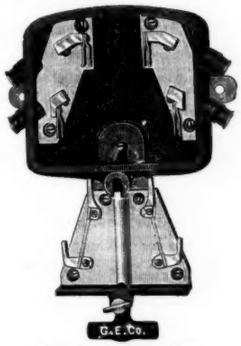


FIG. 5.—SWITCH BOX.

dips into a ring shaped, glass oil cup, threaded onto the insulator pin. This construction effectually prevents any leakage of current from the wire to the supports, even in wet weather.

The transformers are the same as the standard type "F" transformer, except in the method of winding and insulating the coils.

The use of oil in this long distance transmission apparatus is considered extremely desirable, because of the high potential of the "step up" circuit; and the protection it affords against injury to the insulation of the coils can not be over estimated.

Both the primary and secondary coils of the long distance transformers are so wound as to secure the greatest possible inductive effect without any sacrifice of insulation. Mica is freely used, and the greatest care is

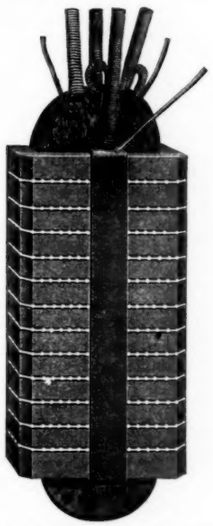


FIG. 6.—INTERIOR OF LARGE TRANSFORMER.

taken both in winding and assembling to make the insulation as perfect as possible. This insulation is in all cases tested to withstand an alternating potential difference of at least 10,000 volts. The transformers are alike, with the exception of a modification in the winding, whether intended for "step up" or "step down" work, the primary of the "step up" corresponding to the secondary of the "step down." The standard size is 25,000 watt capacity, and larger sizes will be built, if desired. It is not considered advisable, however, to build smaller sizes than this.

ELECTRIC LIGHT FLASHES.

The Edison Electric Light Company, of Philadelphia, are about to place four additional stories on their four-story building, No. 908 Sansom street. The improvement will cost about $85,000.

The Union Electric Light Company, which was bought some time since by E. K. Ray and others, is to be absorbed in the Woonsocket Electric Company and the station at Franklin, Mass., closed.

In December, 1892, the Toronto, Ont., Incandescent Electric Light Company reduced the price to customers from one cent per lamp hour to eight-tenths of a cent for a 16 candle-power lamp. The result was that the company's business almost doubled. Now the price will be further reduced to six-tenths of a cent per lamp hour. Gas, it would seem, should cease to be a competitor of electric lighting at this low rate.

The suit of the Edison Electric Light Company, *et al*, of New York, against the Connecticut Glass Company, of Hartford, for an alleged infringement of a patent for making glass bulbs for incandescent lights, was heard before Judge Shipman in the United States Court last week, on a motion of the complainants for an injunction. A modification of the motion was agreed to and Judge Shipman granted an injunction pending litigation of the case.

A committee of the city council and the management of the electric light company, of Woburn, Mass., held a conference last week on the matter of contracting for electric lighting. Last year the city paid at the rate of $648.21 a month. In December last there were several lights added, increasing the monthly cost to $669.46, making the yearly cost $8,033.52. The appropriation of the city for this purpose was but $7,500, and

FIG. 7.—30,000 VOLT TRANSFORMER.

it was to settle the difference that the meeting was held. Although nothing was decided upon, it is thought the company will accept a proposition made by the city, that the latter pay $7,500 per annum for two years. If accepted the matter will be brought before the city council.

The advocates of the Reinœhl Electric Light bill, which fixes the rate for electric lighting all over the State of Pennsylvania at 25 cents per arc light of 2,000 candle-power, have been collecting statistics from all of the towns and cities of the State in which there is an electric light plant, and in every instance find that the price charged is less than that paid in Philadelphia, where 50 cents per night is paid. The highest price paid outside of Philadelphia is in Bethlehem, where 35 cents per night is paid. If the bill passes the price per light will be reduced in Philadelphia, Pittsburgh, Scranton, Erie, Lancaster, Allentown, Johnstown, McKeesport, Chester, Uniontown, Pottstown, Bethlehem, South Bethlehem, Pittston, Nanticoke and Carlisle.

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A very good example of the quick and accurate work required of the modern electrical engineer is afforded by Mr. Ira W. Henry's designs for an electric buoy system to be used in Lake Michigan during the World's Fair, fully described on another page. This novel system, which consists in operating 13 electric buoys in series on an alternating current of 1,460 volts, the current passing through a 14 mile gutta-percha cable, was evolved in a few days and has been favorably passed upon by the proper government officials. We predict that this novel work by Mr. Henry will prove a valuable addition to his reputation as an electrical engineer.

Doubtless the most attractive and striking exhibit at the World's Fair will be the Edison light tower, located in the center of the Electricity Building, and constructed after designs by Mr. Luther Stieringer. This tower will be a beautiful shaft of light rising to a height of 80 feet, capped by an immense incandescent lamp formed of 80,000 pieces of crystal. The design is typical of Victory. The only other column with a colonnade is the famous Column of Victory at Berlin. The General Electric Company and the Phœnix Glass Company have joined forces in making this exhibit, although the completed whole will be in the nature of a personal exhibit by Mr. Edison, who has approved Mr. Stieringer's plans. The exterior of the column will be a typical exhibit of the incandescent light, while the interior of the colonnade will be devoted to showing the many beautiful products in crystal glass made by the Phœnix Glass Company and adapted to electrical purposes. Some of the detail plans for the tower have but just been completed, and the work will be pushed rapidly forward. We have been promised a photograph of the tower, together with complete data, which will appear in the ELECTRICAL REVIEW as soon as they are available.

THE METRIC SYSTEM.

In this number of the ELECTRICAL REVIEW appears an interesting article by Joseph V. Collins, of Miami University, on the timely subject, "The Metrical Reform—its Condition and Needs." Radical changes are always difficult to make, and those who attempt them have hard roads to travel and heavy burdens to bear. It will, however, be only by a concerted movement that anything will be done in this direction. Small attempts are worthy, but they are soon lost to sight and submerged by the great number of difficulties that have to be overcome. The education of the man should be commenced when he is a child, and it would, indeed, be a wild and futile scheme to try to change suddenly from one system of measurement to another. It is a great, and, we should add, a necessary movement, but great bodies move slowly, so slowly indeed that new generations come before the changing process is well under way. The electrical fraternity has foreseen these difficulties, and in the infancy of the age of improvement of this science has taken precautions not to hamper its progress by inflicting upon it measurements and notations which to the beginner would prove brain-racking and discouraging.

ELECTRIC LIGHTS IN STREET CARS.

We have frequently mentioned the many advantages of electric lights over kerosene lamps for the interior illumination of street cars. Passengers who have traveled any distance in trolley cars must have noticed the frequent variation in the intensity of the light emitted by the electric lamps inside the car. This is the only fault they have and it is due to variations in the current supply. If the motorman starts his car suddenly by throwing in a heavy current the lamps will fade down and then gradually regain their normal brilliancy as matters adjust themselves. Where frequent stops are made this variation in the light is annoying and trying to the eyes of passengers who may be reading.

A correspondent says that he notices in traveling on one of the Boston trolley lines, that when a car passes the point where a feeder taps the trolley wire the lights will flare up and then drop to normal until another tapping point is reached when the same thing occurs again.

We suggest to electric railway managers that a correction of this defect would add greatly to the comfort of their passengers, and would undoubtedly be appreciated. Steady light might be procured by installing an inexpensive automatic controller in each car, by which to regulate the supply of current for the lamps, or a small storage battery, charged at intervals from the trolley line by suitable apparatus, might be used.

BRAKES FOR ELECTRIC CARS.

It seems a strange fact that no marked improvements have been made and adopted in brakes for electric cars. The hand variety now in existence is cumbersome and, in a measure, unwieldy. While it is true that it can be depended upon, if the chain doesn't break, or if the motorneer is quick enough, it is not what we should call a perfect piece of mechanical construction. Anything so obviously incomplete as this, is bound to attract the attention of inventors, and it is a wonder that some of these consequent improvements have not been tried and adopted. An inventor in Lowell, Mass., has patented a brake that is said to work well. Reports of a recent trial state that "the car came along at a furious rate, and when half way down the hill the brake was applied, and the car stopped instantly, and so quietly that not a passenger was disturbed in his seat. The trial was in every way a success." * * * This really seems a remarkable brake. And the passengers were not disturbed when the car was stopped instantly. Who would have thought it? Probably they were wooden Indians screwed to the seats. We have a dim recollection of a car being stopped once "instantly," and if we remember rightly, it took the motorneer and passengers some few minutes to extricate themselves from each other and return to the usual and normal condition of passengers. Come, inventors, there is a fair field open for a good, reliable, automatic brake. Who shall be the first to carry off the prize?

LETTERS FROM A LABORATORY.—XL.

BY JULIAN A. MOSES.

The numerous devices for obtaining a motion in a straight line which may be both accurate and regular, and controlled by a rotary movement in the form of a wheel or thumb screw, have all been tried by the instrument makers, and it may be said that each has his own particular preference, although the majority favor what is known as the rack and pinion. The single, double and triple threaded screw are good enough for adjustments that are not necessarily accurate, and their rapidity, especially in the case of the triple thread, is a point to commend them. Naturally there must be considerable play, otherwise "binding" is apt to follow and a continued use of this form of adjustment, unless it is substantially made of very hard metal, is liable to cause dissatisfaction. Triple threaded screws are not easy to make, and a perfectly fitting one without any slack motion may be considered quite an artistic piece of work. Only skilled workmen can make them.

The chain movement is another which is useful to the instrument maker, but in it we are dealing with numerous joints which are each liable to rust, wear, or become unmanageable, thus magnifying the difficulties, and making its adoption either a result of unchangeable circumstances or of mechanical conservatism, which latter, it must be confessed, is only a too prominent trait in the best instrument makers.

The rack and pinion movement, by all means the best, is one which is rather difficult to obtain accurate, and in the case of microscope work, precision is of the utmost consideration. Nevertheless, the best makers have adopted it and it has become the standard.

The average rack and pinion fitting in Europe surpasses the average of the product of the workmen of this country. But the reason may be stated that we are a nation of rapid and progressive workers and do not wish to take the time to perform a tedious mechanical operation such as necessarily is the fitting of a rack and pinion.

To provide for this desire for a combination of speed with accuracy, a few years ago I devised a method whereby this could be accomplished and an accurate rack and pinion movement constructed in a very much shorter space of time than that usually required by instrument makers working at the bench and foot lathe. It is as follows: Determine beforehand the best dimensions of the pinions to suit your purpose. Usually for moderately coarse adjustment a diameter of about a quarter of an inch is advisable. Pinion wire may be bought at any well equipped hardware store and should be selected with due regard to its straightness; being drawn it necessarily has a uniform diameter, but the cogs are liable to be warped or slightly twisted. Turn off the cogs to allow for bearings on either side of the pinion, being careful not to turn off too much at once or to strike it in any way, for a pinion is a delicate object while it is revolving in the lathe and must be treated with consideration. Grind the pinion while it is still in the lathe, using medium coarse emery and lard oil and a ring of some hard wood, such as mahogany, upon the inside of which should be spread the grinding material. This ring enables the pinion to be ground either upon a concave or a convex surface, although it is perhaps not as convenient as a revolving solid wheel which makes the pinion act as a "knurling iron."

To make the rack after the pinion is once ground is but a small matter. Procure a tin "pencil box," which may be obtained at any stationers, remove the cover and file the top perfectly flat. Fill this with a mixture of about four parts of bees-wax to one of resin. Scrape off the wax even with the top of the box and slightly sear this top surface with a hot iron rod rapidly passed over it resting the rod in its passage on the edges of the box. Fit the pinion in a temporary wooden bearing and roll it backwards and forwards on the box of the wax composition. Thus will the impression of the teeth be formed. An impression of this must now be taken in fine plaster or other suitable material and alongside of the impression of the teeth of the rack must be laid two strips of wax in order to deepen the rack and bring it to the required thickness. This impression must now be prepared for electrotyping in the usual way and coated rather heavily. The filling should be of a tough metal and this reproduction will be a perfect counterpart of the original in the wax, which was produced by the pinion itself.

While this process may be rather long for the production of one rack, they may be reproduced by electrotyping so that for the instrument maker himself it is no more trouble to make one than to make a great number.

CORRESPONDENCE.

OUR BOSTON LETTER.

The Milton Light and Power Company, of Milton, Mass., are contemplating a very extensive extension to their lines this spring, embracing a large amount of new territory.

The Westboro Electric Light Company, of Westboro, Mass., will extend their lines to Northboro, and are enlarging their central power station. They are in the market for new apparatus.

The State Reform Schools at Westboro, Mass., are soon to be lighted entirely by electricity. Plans and specifications are now being drawn up and estimates for the necessary apparatus and supplies will soon be called for.

The Consolidated Street Railway Company, of Worcester, Mass., have purchased four acres of land having a frontage of 800 feet on the line of the Boston and Albany Railroad, in that city, on which to erect their power station.

The Mather Electric Company, Boston, Mass., have secured the contract to equip the Bristol Mills at New Bedford, Mass., with an incandescent light plant of 1,000 lights capacity. This contract was awarded to the Mather Company after careful investigation by the mill owners and in the face of the strongest competition.

Geo. A. Beatey, of No. 620 Atlantic avenue, this city, has secured the contract for the entire equipment of the electric plant which is to be installed in the six factories of S. R. Wormwood, at South Boston. When completed, this will be the largest private plant in or near the city. Mr. Beatey will receive bids for construction and machinery.

At the Annual Meeting of the Woonsocket Street Railway Company, held April 4, officers were elected, as follows: J. P. Ray, president; J. M. Klingelsmith, general manager, and W. Whittlesey, of Chelsea, Mass., treasurer. Plans for the construction and equipment of the new road are being pushed, and the old Harris Mills will be fitted up as a power station.

For Some Weeks Past the men employed in the mechanical department of the West End Railway Company have been complaining of excessive hours of labor and too little compensation for overtime. At the final conference held Wednesday of last week the announcement was made by the company's representatives that 56 hours should be the week's work, payment to be by the hour in even money, wages to be advanced in every case 20 per cent.; overtime from 6 o'clock to 9.30 P. M., to be paid at the rate of time and a quarter; after 9.30, including holidays and Sundays, to be paid at the rate of time and one-half. The workmen, who number some 1,800, are well pleased at the nature of the concessions made.

The West End Company have evidently come to the conclusion that in many schemes now being advanced for the solution of the rapid transit problem in Boston, the safest position for them to occupy will be that of a spectator rather than a participant. They have expressed their willingness to abide by whatever may be decided upon as most likely to accomplish the desired result, and have offered several plans and estimates for the consideration of the rapid transit committee. The discussion has waxed so warm, however, that they have finally decided to stand aside and let the committee fight it out among themselves. They have sent the chairman a letter withdrawing all propositions heretofore submitted by them, and stating that they wish to be considered out of it in the future. President Henry M. Whitney states that all plans and drawings belonging to the West End Company are still at the disposal of the committee.

The Rapid Increase in the number and extent of electric street railways within the past few years has made new legislation in a number of cases a necessity, and among these the matter of grade crossings is of special importance. When the law was framed giving a majority of the selectmen of a town, which "majority," by the way, generally consists of only two men, the power to grant a location for a street railway to cross a steam railroad at grade, it was not foreseen what rapid strides would be taken in the development of electricity as a motive power. An idea of what has been accomplished may be gathered from the fact that during the past year there have been built in Massachusetts 140 miles of new electric railway, 63 miles of horse railway have been changed to electric railway, and 99 miles of electric railway were under construction at the close of the year September 30, 1892, making a total of 302 miles built and projected in a single year. The street railways of Massachusetts now have a mileage of 814 miles, of which 492 are operated in whole or in part by electric power, and represent a financial investment of $40,000,000. In view of these facts, which are merely an indication of what is to come, due care should be exercised by those having this matter of grade crossings in hand, and every possible precaution adopted for the safety of the traveling public.

Boston, April 8. H. G. T.

OUR CHICAGO LETTER.

John H. Reid has severed his connection with the Detroit Electrical Works.

E. P. Morris, inventor of the Morris pole top, is now stationed at Indianapolis.

Chas. G. Hawley, of the electrical patent firm of Paul & Merwin, at Minneapolis, spent a few days in this city last week.

George Cutter has been spending several weeks in the East, and will hereafter handle the Fiberite railway insulators in the West.

D. B. Dean has severed his connection with the McGuire Manufacturing Company to accept a more lucrative position with the Terre Haute Car and Manufacturing Company, of Terre Haute, Ind., with headquarters in Chicago.

Central Electric Company are kept very busy filling orders. Their business in Okonite wire, conduit and general supplies was never so great, and their large capacity for taking care of their customers is being tested to the utmost at this time.

Mr. Romaine Mace, the genial representative of the Interior Conduit and Insulation Company, is again able to attend to business, after having been confined to the house for ten days with a severe attack of grip.

We are Pleased to Hear of the engagement of Mr. Chas. E. Brown to Miss Katharine Graves, announced on Easter Monday. Miss Graves is a charming young lady residing at Buffalo, N. Y. Mr. Brown is well known to the electrical fraternity through his connection with the Central Electric Company, and his many friends extend congratulations.

The Railway Equipment Company report many large sales in overhead material. Prominent among these sales was one in Worcester, Mass. This contract, which was closed through their popular salesman, Mr. F. McCartney, is for the necessary material for 20 miles of double track. The company's latest improved line hangers and pull-offs will be furnished.

The New Socket recently launched on the market by the Central Electric Company is meeting with favorable results, and it is being supplied in large orders. They are making a specialty of porcelain branch blocks, cut-outs, etc., and are having an unusual demand. Their pin and bracket factory is running night and day, and can scarcely keep up with the demand.

The Electrical Installation Company, of which Lewis E. Myers is general manager, have just closed a contract to build the extensions for the Calumet Electric Railway of Chicago. The first installation of new line will amount to about ten miles of double track, with the following mileage on streets given below:

Stoney Island avenue, 3¼ miles; Ninety-first street, ½ mile; Commercial avenue, ½ mile; Sixty-seventh street, 2½ miles; One Hundred and Nineteenth street, 2 miles; Michigan avenue, 1½ miles.

Chicago, April 8. M. J. B.

A Raise in Wages.

The Twin City Rapid Transit Company, of which Thomas Lowry is president, controlling the street railways of Minneapolis and St. Paul, has issued an order voluntarily raising the wages of all motormen and conductors in the two cities on June 1. Those who have been in the employ of the company one year or more are raised from 17 cents per hour to 20 cents. Those who have been in the service less than one year will be raised from 17 to 18 cents per hour. The raise involves an added expenditure of $75,000 per annum.

Banquet to Manager Dealy.

The telegraph operators employed at the Western Union main office, at 195 Broadway, on Tuesday evening last tendered a banquet to Manager W. J. Dealy, in token of their approval of his promotion to the post of superintendent of the company's commercial news department. Plates were laid for 400 guests in the Central Opera House, Sixty-seventh street and Third avenue.

A valued correspondent writes to us from Chicago asking that we urge upon electrical exhibitors at the World's Fair the necessity of placing at once any insurance they may desire on their exhibits. There will be much more value than the insurance companies can possibly write, and it will be a case of first come, first served.

New Appointments in the Brush Company.

Charles W. Phipps, who has grown up in the factory of the Brush Electric Company, having started in prior to 1880 as a boy, and who has represented the Brush Company in construction work in England and on the Continent, and China and Japan, and in the Eastern portion of this country, with headquarters in New York, has recently been appointed superintendent of the Brush Company.

Mr. Phipps is noted for his energy and push, his thorough knowledge of Brush apparatus and his ability as an engineer. He is a man who is very popular with all those who have come in contact with him.

At the peril of his own life he rescued a number of sailors in the bay at Yokohama, Japan. His action in climbing the arc light post at the corner of Sixth avenue and Thirty-third street, New York City, during a storm, in the presence of several thousand people and rescuing a lineman of the United States Electric Illuminating Company, was heroic and gave him a deserved reputation of being a brave man. Any one with such a record will no doubt succeed anywhere.

Charles N. Black, a graduate of Princeton, and one of Prof. C. F. Brackett's most promising pupils, has been appoined assistant superintendent. Mr. Black, after leaving Princeton, secured a position in the Brush factory, and, with hard work, combined with his knowledge and ability, has secured just promotion.

H. J. Wendorff has been appointed general purchasing agent of the Brush Electric Company. Mr. Wendorff, for a number of years, has had charge of the Brush stock rooms. He takes the place of L. W. Bradley, resigned.

L. H. Rogers, of Boston, Mass., who has been connected for some time with the General Electric Company, has been appointed assistant general manager of the Brush Electric Company. He has moved his wife and family to Cleveland and will reside here. Mr. Rogers some years since was connected with the New York office of the Brush Company.

In our report of the meeting of the Short Electric Railway Company, of Cleveland, Ohio, we omitted to state that Wm. Hazelton, 3d, was appointed to be assistant general manager of the company. Mr. Hazelton has been connected with the Short Company for a number of years.

PERSONAL.

Mr. R, R. Bowker, first vice-president of the Edison Illuminating Company, of New York, sailed for Europe last Saturday.

Captain W. Wolcott Marks, Company F, Ninth Regiment, N. G., S. N. Y., has been presented with the silver medal of honor for service extending over 15 years. Captain Marks is prominently connected with the Bishop Gutta Percha Company, of this city.

Josiah R. T. Davis, formerly of Harrisburgh, Pa., has opened an engineering office in New York city, in the Havemeyer building. Mr. Davis is an experienced electrical and civil engineer, thoroughly familiar with this class of work in all its modern applications, and the REVIEW is pleased to welcome him to the metropolis.

Mr. F. G. Beach, general superintenent of the Central Union Telephone Company, has been promoted to be its general manager, the appointment taking effect April 5. His office will be at Room 1306 Ashland Block, Clark and Randolph streets, Chicago. Mr. Beach is widely known as one of the most capable telephone officials of the country as well as a very popular gentleman.

Mr. John C. Yager, formerly division superintendent of the Wagner Palace Car Company, has recently been honored with promotion to the general superintendency of the company, with headquarters in New York. Mr. C. D. Flagg, the former general superintendent, has been elected second vice-president. In the promotion of these capable and popular gentlemen the Wagner Palace Car Company has shown proper appreciation of loyal and intelligent members of its official staff.

WORLD'S FAIR NOTES.

To the regular visitor the great change in the appearance of Jackson Park during the past month is readily noticed. The work accomplished shows what the management can do with the assistance of 1,500 men, when they realize how limited the time is before opening day. The past week of fine weather has been most acceptable to the chiefs, and work in their various departments is being pushed to the utmost capacity. Exhibits are arriving in large numbers, and it is estimated that at least 150 car loads are received daily, which are being placed without any noticeable delay. Electricity Building now presents a business-like appearance, as the various companies have begun to install their exhibits. The booth of the American Bell Telephone Company is the first one to be completed, to the outside appearance, and a most beautiful structure it is. The Western Electric Company's booth is nearly completed and work on smaller structures has begun. The General Electric Company is placing its exhibit in space allotted them just south of the center of the building on the main floor. They already have in the building a number of Thomson-Houston machines, from the big multipolar generator down to a tiny motor, which they are rapidly placing for their display. This company is also erecting an immense tower, 80 feet in height, on the main floor, in the center of the building, for the purpose of displaying the Edison incandescent lamp. It is claimed that, when completed, the number of lamps to be used in making this display will reach nearly 20,000. The lower portion of this structure will be used by the Phœnix Glass Company for their display, which is to be on a grand scale, and it is safe to say that, when completed, it will be one of the most conspicuous features of the building. The scene in Machinery Hall is most lively, with its hundreds of men busily engaged in placing the massive machinery with the aid of large electric traveling cranes. The Westinghouse plant in this building is being installed. They have now in use two 4,000 light machines which supply light previously furnished by the old temporary plant which was last week abandoned and torn down to make way for the erection of the permanent building. The balance of the Westinghouse dynamos are in the building and will be placed ready for service before May 1. Besides the ones mentioned, there are several machines of various types run by the small engine now in operation.

The mammoth 2,000 horse-power engine which is furnished by the Edward P. Allis Company, of Milwaukee, is being put together and will be in readiness to furnish power opening day. This is the largest stationary engine ever constructed, and is sure to attract the attention of visitors to this building more than any other exhibit.

M. J. B.

Arc Light Posts Condemned.

At a meeting of the New York Board of Electrical Control held on Monday, April 10, Mayor Gilroy moved that all electric light posts not erected in conformity with the rules of the board be removed from the streets. The resolution was adopted. The order affects about three-fourths of the posts in New York city, and the electric light companies are consequently excited, as it will cost about $75,000 to conform to the rules of the board, which call for posts with cast iron bases and wooden tops. Such poles have been erected in Broadway, Sixth avenue, Forty-second, Twenty-eighth, and a few other streets. In almost every other thoroughfare which is lighted by electricity the companies have put up plain wooden posts, much cheaper than the regulation posts, which cost about $50 each.

After the meeting was over the representasives of the companies crowded about Mayor Gilroy and asked him to give them a few days of grace to change to proper posts. The Mayor referred them to Secretary Theodore Moss, who, with Engineer Kearney, will direct the removal of the objectionable sticks.

It was ordered that low tension subways be built in 125th street, between First and Third avenues; in Sixty-fifth street, from Ninth to Eleventh avenues; in Seventh avenue, from 110th to 138th street (on both sides of the street under the sidewalks.) High tension subways were ordered in Pearl street, from John street to Hanover square; in Battery place, from Greenwich street to West street; in Park place, between Greenwich and West streets; in Spruce street, between Nassau and William streets; in Avenue B, from Seventh to Fourteenth streets; in University place, between Waverley place and Fourteenth street, and in Fourth avenue, from Fortieth to Forty-second street.

The Metrical Reform—Its Condition and Needs.

BY JOSEPH V. COLLINS, MIAMI UNIVERSITY, OXFORD, OHIO.

It is now over a quarter of a century since the use of the metric system was legalized in this country. Unfortunately it seems as far, or nearly as far, from general adoption as it was then. This is true, in the face of the fact that the system has been taught in the public schools more or less extensively ever since its authorization by Congress. Certainly no widespread movement has as yet been inaugurated looking to its general adoption in business and in everyday affairs. Granting that a simple system of weights and measures is very desirable, it would seem that either the metric system is not a very practical one for English speaking people, or it has not been properly presented and taught. Race prejudice and prevailing conservatism may furnish a plausible explanation of the failure of its adoption in England; but these forces have little weight in this country. Indeed, political reasons exist for our being favorably inclined towards any improvements introduced by the French. An illustration of the disposition of our people is seen in the early adoption of a decimal system of coinage which has been a boon of inestimable value to the business man, as also to the school boy. Why have we not likewise adopted its even more economical analogue, the metric system?

There are some aspects of the problem of securing a universal system of weights and measures on which the experience of the last century throws much light. One conclusion is that it does not matter much how the unit of the system is obtained, whether by taking one ten-millionth of the earth's quadrant, or by choosing the length of second's pendulum, or other like unit, since in the nature of the case the prototype metal bar becomes the real unit. Moreover, it is not particularly important whether the unit is a foot or a yard, or a meter in length; only that this unit having been once fixed, all other standards shall be made to exactly conform to it. In the year 1819 a commission of weights and measures was appointed to fix the length of the English unit. Their report was embodied in the Act of Parliament of 1824. The second's pendulum was depended on to furnish a definite and invariable length. Captain Kater performed the necessary experiments and his results were used in constructing the standard yard. The law was scarcely enacted, however, before several sources of error were discovered, and in the course of a few years it was known that this unit was about one five-hundredths of an inch in excess of its theoretical value. "The fault," says Professor Peacock, "which was committed by the authors of the metrical system was similar, both in character and result, to that which was committed by the authors of the Act of Parliament of 1824; the first declared that the mètre prototype is a certain definite and assigned portion of the earth's meridian, *which it is not;* and, if lost or injured, that it shall be restored to the same length, in conformity with its definition, *which can not be done.* The second enacts that the standard yard is a certain definite portion of the length of the second's pendulum, *which it is not*; and, if lost or injured, that it shall be restored to the same length, in conformity with the definition, *which can not be done.* They are lessons which are well calculated to humble the pride of our philosophy, and to teach us to temper the most secure and confident of our convictions by a becoming sense of the very limited powers both of our observation and reasoning." When the representatives of the International Bureau of Weights and Measures* met in Paris in 1875 the first question that came up for discussion was that of of the advisability of redetermining and using a more correct value of the theoretical unit (one ten-millionth of the quadrant); or, making the new standards to conform exactly to those of the archives. The latter course was unanimously agreed upon. The international standard meter, therefore, while differing from that of the archives in form and material, is of exactly the same length. The meter of the archives is of platinum; that of the international committee is nine parts platinum to one of iridium, and is superior to the other in solidity. The new kilogram, like the new meter, was made to conform to that of the archives. The theoretical value of the kilogram is the weight of a liter of water at its maximum density. This determination is therefore that of the committee for the original French commission, and is, of course, somewhat in error. It may come to pass that the requirements of exact measurements will force the adoption of a new kilogram for scientific work. Michelson's studies in the interference of light suggests a novel method of attacking the problem. But, of the effecting of such infinitesimal change in the kilogram standard, the world at large need know nothing, as it would not affect business in the slightest degree.

Another lesson is that the metric system is practical and meets the wants of a great people in international as well as domestic trade. Also its general acceptance has to be effected in the face of strenuous opposition, particularly from the more ignorant classes. The metric system was adopted by France just before the opening of the century. But its introduction was strongly resisted and it was not till 1840 that it came into general use. We have seen the forces at work in the past 10 years for and against the adoption of standard time. Men have ignorantly reasoned that they would be deprived of part of their day by the change. It reminds one of the actions of the citizens of Bristol, England, who thought the change from the old to the new style calendar would cheat them out of 11 days of their lives!

If it be true now that the real unit of length is a standard bar, and the metric system has such a standard, is practical, is used by a considerable portion of the civilized world, and is the only system adapted for universal use, it seems almost a necessary conclusion that other civilized nations should adopt it as speedily as possible and make it a part of their national life. The only objection which could be of weight would be one which showed that the system now in use might be greatly improved on. This may well be doubted of the metric system. The commission which prepared it consisted of Borda, La Grange, La Place, Monge and Condorcet, five of the ablest mathematicians France possessed, and two of whom are the most brilliant the modern world has produced. They gave to the question careful deliberation and aimed at a system which should be at once theoretically and practically ideal. Aside from the construction and care of the standards the problem is not a specially difficult one. There is, therefore, no reason to believe that another commission would be likely to prepare a system in any way superior to that already in use. In view of all this we are almost forced to the conclusion that the main reason for lack of progress in this reform is found in the dearth of a practical knowledge of the system and of its merits. Had the metric system been properly taught from 1866 on, scholars 14 years of age being supposed still in attendance, practically the whole people under 40 would be familiar with it. So far are we from this that many of the favored students of our colleges have only the shallowest knowledge of it.

TABLE.	10000. Myria	1000. Kilo	100. Hekto	10. Deka	1. P. U.	$\frac{1}{10}$. Deci	$\frac{1}{100}$. Centi	$\frac{1}{1000}$. Milli	Decimal point is to be changed in direction of reduction.
Linear.....					Meter‡				One decimal place for each remove.
Square.....			Land hektar	Measure ar.	Sq. Meter				Two decimal places for each remove.
Cubic.....					(Sterr) Cb. Meter	(Liter)	(1 of water weighs 1 gram.)		Three decimal places for each remove.
Capacity.....					Liter				One decimal place for each remove.
Weight*.....					Gram				One decimal place for each remove.

* 1 metric ton = 1,000 kilos (kilograms).
† Used in measuring wood. Besides this denomination there are decister (one-tenth ster), and dekaster (10 sters).
‡ 1 meter = 39.37 inches. (Very accurately, 39.37 + one millionth of itself, or 39.37004 inches.) From this we may calculate the value of every other denomination. In particular, 1 mile = 1.6 kilometers; 1 hektar = 2.47 acres; 1 liter = 1.06 liquid quarts; 1 gram = 15.43 grains; 1 kilo = 2.2 pounds avoidupois, etc.

The secret of this failure, in all probability, may be found in the way it is taught. In order that there may be any satisfaction or progress in the study of the metric system it must be learned as a system complete in itself, and not in its relations to the old. When it is studied in the latter way all the miseries of the old order are multiplied tenfold and heaped on the new, as if the latter were the fruitful cause of all the trouble. If in the process of transition from one system to the other both come to be in use simultaneously, persons familiar with both can make any desired reductions easily and intelligently by means of tables. Until that time comes such reductions will not be necessary except for scientific students and custom house officials.

Two reasons exist for the thorough teaching of the metric system in our schools. The first is because of its almost universal use in scientific works, its common appearance in general literature and the prospective adoption of it in our own country; the second because of its utility in teaching what may be called the theory of metrology. Compound numbers as presented in our arithmetics is a topic of such wide range, its rules are so arbitrary, its parts are so diverse and loosely connected, that very few students arrive at anything like a comprehensive view of the subject as a whole. Now in the metric system the number of tables really essential, the relations of the tables to each other and the dependence of the whole system on the fundamental unit all come out in the plainest light. A clear conception of this is worth a great deal to the student in simplifying for him complex reductionsand as a training in systematizing, to say nothing of the desirability of knowledge of a system so widely used.

The nomenclature of the metric system is very easy to learn. Thus, deci, one-tenth, (c pronounced soft) is in our word decimal; centi, one one-hundreth, corresponds to cent, one one-hundreth of a dollar; milli, one one-thousandth, is the same as mill, one-thousandth of a dollar; these are the sub-multiple prefixes of the unit. The multiple prefixes are from the Greek, and are not all as familiar. However, deka, ten, has the same root as deci, and is easily remembered; and myria, 10,000, gives our English word myriad, a very large number. Hekto, 100, is in our not very familiar English word hecatomb, and only kilo, 1,000, is altogether unfamiliar. Meter, the name of the principal unit, is a word in common use with us as the name of a measure. Thus a gas meter, an electric meter, etc. Ar, the land unit (a square dekameter), is nothing but our word area abridged, and ster, a solid unit, is in our words stereoscope and stereotype. Ton appears in the metric system having the same use as with us. Liter and gram yet remain to be fixed in mind, there being but 13 words in all, including prefixes. Any boy of reasonable ability ought to master a vocabulary of 13 words, only four of which are entirely unfamiliar, in a few minutes. The reductions from one part of any table to another, as every one knows, are performed by simply moving the decimal point. The gateways, in reducing from one table to another, are constructed out of definitions. Thus in changing from any part of the cubic to any part of the capacity table, reduce first to cubic decimeters, equals liters. To show how wonderfully simple and compact the system with its rules really is, the accompanying table is given. It has an advantage over common presentations in appealing to the eye rather than to the capacity for remembering words.

In the column marked P. U. (principal unit) are found the units of the different tables. Thus a meter is the unit of the linear table, a liter of the capacity table. Before these units are to be placed the prefixes, myria-, kilo-, centi-, etc., for the different denominations of each table. Thus the second square in the second row is the "square kilometer" space. The table is really fuller than need be, since some denominations not being really needed, are used only occasionally, or not at all, such as the hektogram, the square myriameter, etc. To these five tables another on money should be added, but which would need international agreement and sanction before its general use could be expected.

To illustrate reductions in the table, suppose it is required to change 36.7 dekameters to centimeters. From dekameters to centimeters is three removes, and the reduction is from left to right; hence the decimal point is moved three places to the right, which gives 3670 centimeters. To reduce .03 square kilometers to ars, there being two removes and two places for each remove, the answer is 300 ars. Again, to reduce, say, 2543871 cubic millimeters to dekaliters, the cubic millimeters are first reduced to cubic decimeters. In this reduction there are two removes to the left and three decimal places for each remove. 2543871 cubic millimeters equals 2.543871 cubic decimeters, or liters. Carrying this number into the liter table, we still have to reduce from liters to dekaliters. The answer is .2543871 dekaliters. As a last example, suppose it is required to find the weight in kilograms of a bar of brass (sp. gr. 8.4) 1.3 meters long, 1.1 decimeter wide, and 2.5 centimeters thick. It is obvious that if one cubic centimeter weighs one gram, one cubic decimeter will weigh one kilogram, a familiar fact to any one using the system. Now, if the solid contents is found in cubic decimeters, this number will be the weight of an equal volume of water in kilograms. Reducing the length and thickness to decimeters, we have

length width thickness cubic decimeters.
13. × 1.1 × .025 = .3575

But the specific gravity of brass is 8.4. Hence the answer is 8.4 × .3575 equals 3.003 kilos. These examples are typical, and no others need be given. A relatively

*The first convention of this institution was held in Paris 18 years ago. There were represented 16 countries, as follows: Germany, Austria-Hungary, Belgium, Argentine Confederation, Denmark, Spain, United States, France, Italy, Peru, Portugal, Russia, Sweden-Norway, Switzerland, Turkey and Venezuela. The French government gave to the Bureau a convenient property on the hills of St. Cloud above Sèvres. Investigations were carried on there for a number of years before the actual work of constructing the standards was begun. The preparation of the standards for the different countries was completed in 1889. The seals of the United States standard meter No. 27 and kilogram No. 20 were broken by President Harrison in the presence of secretaries Blaine and Windom and several prominent scientific gentlemen on January 2, 1890. The Bureau stands ready to supply private parties with standards as they may request them.

small number of exercises like these will perfect a knowledge of the system.

To such a theoretical training in metrical reduction must be added a very few definitely formed mental concepts of the units employed to make the other knowledge of any real practical value. This knowledge, if the proper care is taken, may be gained in a very short time. In the first place, every student of the system ought to be able to estimate very approximately by the eye the length of the chief unit of all, the meter, which is about three and one-half inches longer than a yard. Similarly, he ought to know approximately the size of the millimeter (one-third of one-eighth of an inch or the width of a coarse pen mark); the centimeter, which is a trifle less than four inches, and the kilometer equals .62 mile. A resident of New York city, *e. g.*, ought to know that the river span of the Brooklyn bridge is approximately one-half kilometer, and the whole length of the bridge exclusive of the approaches is one and one-twentieth kilometers. One ought to know that a liter is nearly midway between the dry and liquid quarts, not differing much from either, and that a liter of water weighs a kilogram; that the metric ton weighs 2,205 pounds, or is very nearly the same as a long ton of 2,240 pounds. A little study will indicate which units will be most used and for what purposes. The millimeter will be employed chiefly in scientific measurements, and in places where sixteenths and thirty-seconds of an inch are needed; the centimeter instead of the inch, the decimeter instead of the foot, the meter instead of the yard, the dekameter instead of the rod, the kilometer instead of the mile. The dekaliter will take the place of the peck, the hektoliter is the size of an ordinary barrel (3 bushels), the kiloliter that of the hogshead, etc. If the metric system is ever to be taught in such a way that it will, so to speak, take hold of the mind of the learner, it will have to be done by illustrations of this sort. If it were in actual use in this country the children would absorb it without knowing exactly how, just as they now learn United States money. As matters stand they will have to become familiar with it by means of improvised object lessons.

There may be those reading this who are asking themselves, what is the objection to our present system? Are we not getting along quite well as it is? Perhaps so; but, quite aside from the extra trouble in making reductions of all sorts and the performing of laborious calculations, there are other inconsistencies and crudities of which many persons do not hear. Professor Mendenhall, in a recent number of *Science*, says that "theoretically or rigorously there are about as many systems of weights and measures in use to-day as there are States in the Union. There are cases, indeed, in which no legislation has taken place, and, while there are severe penalties for the use of false measures, there is nothing to fix what measures are true, except, of course, as custom or common law controls." Dr. Franklin B. Hough published a table some years ago showing that there are in this country four different bushels of corn, seven of oats, seven of buckwheat, etc. He pointed out that 1,000 bushels of barley or rye in Kansas was equivalent to 1,500 bushels of the former and 1,750 bushels of the latter grain in New Orleans. He showed that a gallon of milk in Vermont must contain 231 cubic inches and one in New Hampshire 282 cubic inches, the one being the wine and the other the beer gallon. These are only a few of the absurdities he found. Furthermore, the English and American systems, though bearing the same names of denominations, are very far from being in harmony. The United States Congress, urged on by J. Q. Adams, adopted the old wine and Winchester gallons (liquid 231, dry 270 cubic inches) and Winchester bushel (2150.42 cubic inches), and legalized them only a short time before the English commission appointed to restore the standards decided on a new imperial gallon (277.2 cubic inches) and bushel (2218.2 cubic inches). Thus dry and liquid measure in our system are not accordant with themselves nor with the English units. But there is no need of going into this further. The tables and reductions of compound numbers in any arithmetic is argument enough without recourse to other difficulties.

In order to secure any satisfactory degree of progress towards this reform, it will be necessary for the leading educators of the country to take up the question, discuss ways and means very thoroughly, and exert themselves in every possible way to enlist the intelligent interest of the vast army of teachers. The latter, as matters now stand, are prejudiced against this foreign innovation, do not understand it very well, and are in no good position to appreciate the defects of the present order and the advantages of the new. After a little vigorous agitation, it is not too much to hope that the government might be able to introduce the system in the post-offices and custom houses. The educated and well-to-do classes might purchase sets of weights and measures for the instruction of their children and for their own use, and where it would not work a hardship, request shopkeepers to use the system in dealing with them. Standard time was forced through by the railroads. There is no one power, however, able to press forward the metric reform. The educational world and the government may vastly aid it, but neither can secure the immediate results unassisted. Fortunately the efforts made to secure the adoption of metric weights and measures for the 1890 Pharmacopia were crowned with success. When we remember that the whole European continent, except Russia, is now using the metric system, either in its simple form or carefully adapted, and that Russia stands ready to adopt it when England does, and that no better pressure could be brought to bear on England than its use in this country, we see that there is a manifest obligation lying on our shoulders not to delay its universal adoption.

FIG. 1.—UNIVERSAL INSULATING BELL.

FIG. 2.—COMBINATION OF BELL, PULL-OFF AND CLIP.

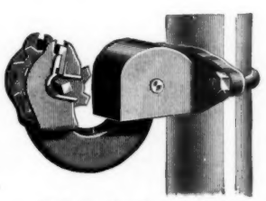

FIG. 3.—INSULATED POLE RATCHET.

Many Thanks, Brother North.

[*From the Safety Valve.*]

Celebrating the beginning of its twelfth year, that enterprising and always interesting journal, the ELECTRICAL REVIEW, of New York, published on February 25 a particularly interesting and instructive issue of nearly 70 pages. We quote the following from the introduction to a handsomely illustrated and well written description of the progress made in all branches of electricity during the past year:

"While the year which closes with this number of the ELECTRICAL REVIEW has not been characterized by the production of any of the marvels in which the electrical prodigy has been so fruitful, it bears evidences of a steady march of improvement, signalized by the introduction of more perfect apparatus and an expansion of the field of application for electrical inventions, the birth of which occurred at an earlier date."

The REVIEW is one of the few technical journals which make intricate matters clear, reducing the higher mathematics and verbal ponderosity in which pedants delight, to simple terms, thus bringing applied science within the ken of ordinary mortals. Sprightly, entertaining and newsy, it is well savored, leaves an agreeable taste on the palate, and, like Boggs' Celestial Pills, aids digestion, tones up the system and brings a healthy glow to the cheek.

It is reported that the street railway of Guadalajara, Mexico, has been sold for $400,000 in silver to Baltimore and Philadelphia capitalists.

Queen & Company, Incorporated.

Queen & Company, incorporated, Philadelphia, are making a special drive of their magnetic vane ammeters and voltmeters, which instruments are favorably known throughout the country. They are adapted for constant switchboard use, and will render service 24 hours per day without disadvantage. This is an important feature and will be appreciated by those familiar with the subject. A number of the larger manufacturing concerns use these meters for installation work, as they present great advantages in being constant, accurate, durable, handsome in appearance and low in price. More than twice as many were sold in 1892 than during the previous year. Circular No. 420, which contains full information, will be mailed by the makers upon application.

Some New Trolley Line Specialties.

The New York Electrical Works, of this city, have lately introduced some ingeniously constructed trolley line specialties. The insulation used by this company is a composition hard and tough, and can be moulded into any form by sufficient hydraulic pressure. Fig. 1 shows a universal bell, which is so constructed as to fit into different kind of hangers. Fig. 2 shows a combination of the bell with another of their appliances, a clip; and Fig. 3 is an insulated pole ratchet, the Medbery insulating composition being used in its construction, and is enclosed, as shown in the illustration, for protection against the weather. This little appliance is convenient of access, and will be appreciated by the linemen.

Improvement in trolley line construction is the order of the day, and any step in that direction, no matter how small, is bound to be welcomed by the public, and especially those who are directly interested.

She Moved.

She was a tall woman with a severe cast of countenance and a mole, from which a good sized goatee depended, on her left cheek. She boarded a Seneca street car the other night and found every seat occupied. No man offered to give her his seat, and she planted herself just inside the door and squarely across the entrance.

"Madam," said the conductor, politely, "I wish you would move forward a little in the car."

"I'll do no such thing," she snapped.

"But, madam," continued the conductor, "people have got to get in and out of this door."

"I don't care if they have. I'll stand here and nowhere else," she said, and her voice was very vinegary.

"I shall have to insist," said the conductor, putting one hand on her shoulder.

She glared at him with unspeakable fury. Then she said, wrathfully: "Take your hands off me, sir. I'll stand here and nowhere else."

"But I insist—"

"I don't care what you do. I have paid my fare and I won't be bossed around by no boy of a conductor. I'll stand here and you nor no one else can make me move a peg."

Just then the motor man tried to slow down his car and, by mistake, shut the current off entirely. The car stopped suddenly and the tall woman went plunging down the aisle and landed on her knees near the front door.

Everybody smiled, and the conductor laughed aloud. She picked herself up and shouted furiously: "Laugh, blame you, but I want you to understand you didn't make me move!"—*Buffalo Express.*

ELECTRIC RAILWAY AND POWER NOTES.

Pottsville, Pa., electric railway employés threaten to strike for 15 cents an hour and a nine-hour day.

The Philadelphia and Harrisburg trolley trunk line will build a $750,000 power house at Coatesville, Pa., which will furnish 6,000 horse-power.

It is rumored that the New York and New England Railroad intends to fight against having the electric railroad cross their tracks at Hopkinton, Mass. This may cause some trouble.

The projectors of the Pittsburgh, Neville Island and Coraopolis Electric Railway expect to get the line in operation at no distant date. From McKee Rocks to the end of the line the road will cost $135,000.

New York city has entered suit in the Supreme Court against the directors of the Third Avenue Railroad Company for $50,000 damages for failure of the road to deposit $1,000,000 last January when it bid for the privilege of building extensions on Lexington avenue and other streets.

It is reported that Messrs. Widener and Elkins, of the Philadelphia Traction Company, admit that they are about to connect Baltimore and Washington by a trolley road. They evaded the question as to whether the line would be extended to Philadelphia, although it is thought that a line between Baltimore and Philadelphia will soon be in existence.

The council of Doylestown, Pa., last week granted to the Philadelphia and Allentown Electric Trolley Trunk Railway Company the privilege of stringing wires through the town and the right to occupy streets. The proposed road is from Doylestown to Perkasie, and the portion from Doylestown to Quakertown is expected to be completed August 1.

The common council of Yonkers, N. Y., have passed a resolution requiring the electric cars to be run at a rate not to exceed one mile an hour when approaching the arch of the Croton Aqueduct on Nepperhan avenue and the intersection of that avenue with New Main street. At either point there is great danger of a serious accident, and too great precautions cannot be taken to guard against such a catastrophe.

President Norton, of the Atlantic Avenue Railroad Company, of Brooklyn, N. Y., has decided to substitute electricity for steam as the motive power on the Brooklyn, Bath and West End Railroad. Canvassers have been sent out to gather consents from the property owners along the line of the road. When the substitution is made the West End road will be connected with the Atlantic avenue system and through trains will be run to Coney Island from South and Fulton ferries.

The Cayadutta, N. Y., Electric Railroad Company last week purchased $32,500 worth of the capital stock of the Johnstown and Gloversville Horse Railroad Company, thereby securing control of the latter road. After the transfer of the horse railroad stock the new stockholders elected as directors William P. Myers and Adam Z. Wemple, Fultonville; Jacob Hayes, Fonda; James Shanahan, Jr., Tribes Hill; William Ferres, John M. Russell and James Younglove, Johnstown; and George C. Burr, J. H. Place, John H. Stockamore and Hon. Horace S. Judson, Gloversville.

A letter was received last week by the chairman of the Massachusetts rapid transit committee, at the State House, from President Whitney, stating that the West End Street Railway directors do not feel that they are familiar enough with the Greathead system of tunnelling to warrant them in going forward on any system of tunnelling in Boston, and they, therefore, withdraw all propositions now before the committee. They do not desire that the committee consider them further in the matter, and all the plans and drawings, the property of the West End Company, are at the disposal of the committee.

Long Distance Transmission.

"Long Distance Transmission of Power by Direct Currents" was the topic of a talk by Frank Kitton before the Buffalo Electrical Society, at a recent meeting. He stated that the use of direct currents had not lately received the same attention as alternating currents for transmitting power, probably because it was thought by many that they could not be utilized with the same degree of economy in covering great distances. That, perhaps, the greatest difficulties in this respect appear when considered from a standpoint of constant potential transmission, when such factors as "pressure," "size of conductor" and "loss" appear to "whipsaw" with each other, and that it had not appeared practicable to transmit a large amount of power to a considerable distance, with a satisfactory degree of economy by means of direct current at a constant potential; while, on the other hand, more or less success has been attained with power transmission by direct currents on a constant current system, such systems being in apparently successful operation at home and abroad. It was understood that the proposition to transmit power to the World's Fair at Chicago, obtained from the Falls of Niagara, was based on such a constant current transmission.

Mention was made of a constant potential transmission recently patented by Mr. Chas. S. Bradley, which presented some novel features that, it is claimed, will obviate the difficulties referred to. Mr. Bradley proposed to obtain a sufficiently high voltage for his purpose by connecting a number of generators of comparatively low potential, in series, thus overcoming the difficulties experienced in constructing commutators, and securing insulation in armatures which, under ordinary conditions, will not withstand the excessively high voltage necessary, and at the receiving end placing an equal number of motors in series for reconversion of the electrical energy into mechanical motion.

It is said that this system "involves features for rendering the operation safe, both for the machines themselves and for the operators who attend them," that "such an invention brings the direct current machine, which has a very high efficiency, into the field of long distance transmission of power. Heretofore such machines have been limited to power transmission over short distances," and "is designed to render practicable the development of a direct current of high potential and its reconversion into power at the end of a transmitting line."

One of the novelties of the system appeared to be the use of series connected generators in a constant potential system of transmission. The question naturally arises, what are the advantages to be derived from transmitting power by such a system under constant pressure that are not already secured in a somewhat similar arrangement of generators for maintaining a constant current, with an equally high pressure, but which varies with the load.

A lengthy discussion followed, bringing out some interesting facts.

Mr. Frank C. Perkins, who has recently returned from abroad, where he had obtained much information on the subject, said:

I do not see the novelty of the invention of Mr. Bradley, for the reason that in looking up the principal central stations for transmission of power in Austria, Switzerland, France, Germany and Italy, many different systems were found to be in use with varying success, and a station at Genoa, Italy, was among the most interesting, as it was operated by almost exactly the same arrangement as indicated by Mr. Bradley. The electromotive force used was 8,000 volts, a direct current being used for the transmission. The system is that of R. Thury, electrician of Cuenod, Sautter & Company, Geneva, Switzerland, and is on the same general principle as the plans they submitted for transmission of power by electricity from Niagara to Buffalo, at the request of the Niagara Commission. These plans took the highest prize awarded at that time. Undoubtedly because the three phase alternating system had not at that time been so thoroughly investigated. The total distance of transmission at Genoa is 26 kilometres. The company operating the station is the "Societa Acquedotto Defewari Gallaiera," with a capital of 5,000,000 francs. The power obtained is from a small stream in the mountains near Isoverda and Pontedicemo. The total fall is 450 metres, and there are three stations built up the mountain side, each having a fall of 150 metres, the same water being used over three times. The highest station is called Paccinotti, the second Volta, and the third Galvani. From each station there are two conductors running to Genoa, Italy, making three distinct motor circuits, each carrying from 4,000 to 8,000 volts, according to load. The motors are all connected in series and vary from 6 to 60 horse-power, a constant current being used of 44 amperes, and a variable voltage of from 50 to 1,150 volts for each motor, according to size. The current in the line is constant, and the pressure varies with the load. Each station has five turbines of 140 horse-power. The speed of each turbine is 475 revolutions per minute. To each turbine two Thury dynamos are directly coupled, having a capacity of 70 horse power each, with a normal potential of 1,050 volts. The turbines were constructed by Faesch & Piccard, of Geneva, Switzerland, the firm whose plans for the Niagara plant took the highest prize for turbines by the Niagara Commission. There are two pipes conducting the water to the turbines for each station, averaging about 250 metres in length and a half a metre in diameter. One of the turbines and two dynamos are held in reserve for use in an emergency.

These generators are all connected in series, making a total pressure on the line of something over 8,000 volts when the eight machines are running. The line consists of two copper wires nine millimetres in diameter and each 26 kilometres long; at a careful test made on a rainy day, the loss on the 52 kilometres of line was less than $\frac{1}{10}$ of one per cent., the electromotive force at the time of the test being 4,000 volts.

The governor used is an electric one of Mr. Thury's design. Two direct current machines of 150 amperes and 100 volts each, are connected directly to a turbine of 15 horse-power. One of the dynamos is held in reserve and the other used for regulating the field of the other dynamos. When a large electric motor is thrown out of use in the city of Genoa, the electric governor slows down the small water motor by an electric valve, and the exciter then furnishes less current to the field of the large generators, so that the potential of the line is reduced in proportion to the number of motors thrown out of the circuit. The regulator works very nicely, as was seen at the station Volta, while in operation. The generators have a guaranteed efficiency of 92 per cent., and the motors over 30 horse-power also have an efficiency of 92 per cent., while the motors below 30 horse-power are stated to have an efficiency of 88 per cent.

The motors in the city of Genoa are directly connected to incandescent low potential machines and arc machines for distribution throughout the city.

F. E. Reed & Company, Worcester, Mass.

The plant of Messrs. F. E. Reed & Company, which is located at Nos. 120, 122 and 124 Gold street, is one of the most extensive machine shops in Worcester, Mass., and its products are favorably known in all parts of the world. Their specialty is the manufacture of machinists' tools, principally engine lathes and milling machines. As shown in the illustration, the plant occupies three large buildings, and employment is furnished to about 200 men. The floor space of these shops, exclusive of outbuildings, is about 1¼ acres. The business was established by Mr. Reed in the year 1875, on Hermon street, occupying at that time but a portion of one room, and only employing six or seven men. It had a steady growth, until its present large proportions have been attained. The present main building was erected in 1883, since which time frequent and large additions have been made, the firm still possessing extra ground, giving them plenty of room to grow in, which growth will undoubtedly come in the near future.

Few machine shops are so well lighted, there being an abundance of large, clean windows, and a private isolated electric light plant, the first established in Worcester, furnishing incandescent lights in every room of every building on dark days and in the early morning and late afternoon. Mr. Reed has also large interests in several other manufacturing concerns which have been of benefit to the community in many ways.

This firm have just completed bringing

Plant of F. E. Reed & Company.

out new patterns for their standard line of engine lathes, from 12 to 30 inches swing, being larger, heavier and better lathes than they have heretofore made, and need to be seen to be fully appreciated. They will send an illustrated catalogue on application.

FINANCIAL.

The Edison Electric Illuminating Company, of New York, after paying the regular quarterly dividend of two per cent., is reported to have cash on hand to pay a large extra dividend if the directors see fit.

A news dispatch from Boston quotes a director of the General Electric Company as follows: "General Electric is earning more than Pullman per share of stock, but the General Electric charges off a large amount before presenting its surplus account to the stockholders."

The strength of New York Edison Electric Illuminating Company's five per cent. first mortgage bonds, and the high prices at which they have been sold, as compared with other electrical securities earning a similar amount, is due to the fact that they are exchangeable into stock of the company, dollar for dollar. It was for the purpose of taking up this bond issue of $3,250,000 the company increased its stock $3,500,000. These bonds are exchangeable on June 21 and January 21 during the years 1892 to 1895, both inclusive, upon 90 days' notice. The exchange of the bonds for the stock will give stockholders a six per cent. stock security for a five per cent. mortgage security. This is obviously in favor of the bondholder, but also has its advantages to the company as it relieves it of all encumbrances. Again, at the time the bonds were issued and were made exchangeable into stock, the stock was on a five per cent. basis, the increase to six per cent. having been but recently made.—*Boston News Bureau.*

The Building for the Press Club Fair.

On May 1 the Press Club of this city expect to open their mammoth fair in the Grand Central Palace, a building situated on the block bounded by Forty-third and Forty-fourth streets and Depew and Lexington avenues.

This building, which up to the present moment has been rather modest in its attempt at attracting public attention, contains more aggregate floor space than any other building of its kind in this city. The Press Club Fair, it is expected, will occupy the whole of the six floors, which have a total of over 250,000 square feet of available surface.

The lighting facilities of this enormous structure have been installed by the New York Electrical Equipment Company, of which Mr. S. Bergmann is president. They are complete in every respect, and several unique features have been embodied in the work, which was installed under the supervision of Mr. Augustus Noll, the superintendent of the company.

The engine room, situated on the ground floor, is equipped with a 275 horse power Fishkill Corliss engine. The fly-wheel is belted to a driving shaft, from which the three 45 watt Edison generators are run. An idle pulley on each dynamo and corresponding ones on the shafting enable the dynamos to be conveniently started or stopped as occasion may warrant. Room is allowed for the introduction of three other generators, which will make the total lighting capacity of the building 5,100 sixteen candle-power incandescent lamps.

The handsome switchboard of marbleized slate is supplied with all the most perfect central station devices, and the current may be controlled by 16 cut-outs and seven large switches, and each individual chandelier may be connected at will. The current is distributed on both the two and the three wire systems, and interior conduit tubes are used throughout.

The main hall, tastefully decorated in cream and gold, is admirably lighted by seven large chandeliers, holding each 100 lights, arranged in groups of three, five and eight. It is illuminated during the day by a dome of corrugated glass protected above and below by wire gauze, intended to avoid any possible accidents due to breaking of the glasses. This main room will seat comfortably some 3,000 people, and two tiers above the main floor will be divided into boxes.

The floor space around the main hall will be lighted by 700 more incandescent lamps arranged on the posts on branched wall brackets, devised to obtain the most general illumination. The other floors of the building will be illuminated by single hanging lamps, and it is expected that the spacious roof will be converted into a garden; that the dome will be covered over and the entire space will be lighted by arc lamps.

The lighting of this building is ample for all needs, and is much better than that afforded in many other similar buildings.

The possibilities for an electrical display have been taken into consideration, and a committee has been appointed to take charge of this matter.

Electricity vs. Steam.

The recent performance of the Empire State Express of the New York Central, which ran at the rate of 95 miles an hour for 10 consecutive miles, has greatly interested mechanical engineers and scientific men generally. This remarkable record is expected to have a very important bearing upon railroad schedules of the near future, and is especially interesting at this time, when extraordinary efforts are being made to reduce the time between distant points by means of electricity. Until lately 80 miles, or perhaps 83, had been the fastest time made by any railroad, and this speed of 95 miles an hour by a complete train, weighing in the neighborhood of 200 tons, and running over different grades, throws new light upon the question of attainable speeds, and gives some data from which to work and figure for the future.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week:

New Electric Railways.

WATERDOWN, CAN.—The Waterdown and Guelph Electric Railway Company; capital, $50,000. Incorporators, John Nicholson, of East Flainboro; John Owen McGregor, of Waterdown; Jacob Flatt, of Hamilton; and Sir W. P. Howland, of Toronto.

WORCESTER, MASS. — The Consolidated Street Railway Company will build a new power house.

WASHINGTON, D. C.—The Brott Electric Rapid Transit Bicycle Railway Company; capital, $300,000. Incorporators, W. F. Brott, president; C. H. Davidge, treasurer; and C. A. McEwen, secretary. The object of the company is to purchase an interest in the inventions of G. F. Brott for improvement of electric bicycle railways, and to sell rights to build such railways.

STONEHAM, MASS.—The Wakefield and Stoneham Street Railway Company has asked the legislature for leave to extend its railway, equip the same with electricity, build a power house and increase its capital by $200,000.

RED BANK, N. J.—Property owners along the route of the proposed electric railway, from Red Bank to Long Branch, are being petitioned for right of way. The promoters of the enterprise are Robert P. Sherwood, of New York; C. T. Cobart and W. W. Conover, of Red Bank.

GLOVERSVILLE, N. Y.—The Cayadutta Electric Railroad Company, which is building a road from Gloversville to Fonda, has purchased a controlling interest in the horse car line from Gloversville to Johnstown, and within the next 30 days the motive power will be changed to electricity. The line to Fonda will be completed by May 10.

WOODBURY, CONN.—An application for a charter for an electric railroad between Watertown, Woodbury, Hotchkissville, Southbury and Southford is pending before the general assembly.

CHARTIERS, PA.—The Shereden Terrace Passenger Railway Company has been incorporated with a capital stock of $12,000.

WILLIAMSPORT, PA.—The Hollywood and Grand View Passenger Railway Company, capital stock, $24,000, has been incorporated.

MECHANICSBURGH, PA.—The Harrisburgh Electric Motor Railway Company has asked for a franchise through the principal street of Mechanicsburgh.

AUGUSTA, ME.—A bill authorizing the Shore Line Railroad Company, a steam railroad, to use electricity as a motive power has passed the State legislature.

MOBILE, ALA.—The Mobile Light and Railway Company is the name of a new corporation formed by the consolidation of the Mobile Electric Railway Company and the Mobile Electric Light and Power Company.

NATICK, MASS.—The Natick Electric Railway Company has been granted permission to change its name to the South Middlesex Street Railway. It will extend its tracks to Hopkinton and Ashland.

SPRINGFIELD, MASS.—The proposition of building an electric railway from Thompsonville to this city is being seriously considered by the Springfield Street Railway Company.

MILLVILLE, N. J.—The Millville Rapid Transit Company has secured its franchise. The trolley system will be used.

GREEN BAY, WIS.—Work will begin at an early date on the construction of the Green Bay Electric Street Railway.

DOVER, DEL.—The House has passed the St. George's and Kirkwood Electric Railway bill. The contemplated road will run from Kirkwood *via* St. George's and Delaware city to Port Penn.

CHARLESTON, S. C.—The Great Western Electric Manufacturing Company, of Chicago, will probably secure control of the Enterprise Street Railroad. Electricity will be substituted for mule power.

INDIANAPOLIS, IND.—H. H. Stevenson represents a syndicate which will build an electric road from Indianapolis to Martinsville, 30 miles.

Electric Light and Power.

NORTHPORT, N. Y.—The Northport Electric Light Company has been incorporated with a capital of $25,000. Directors, J. W. Fowler, J. W. Olmstead, I. Darling and others.

COBLESKILL, N. Y.—The Courter Electric Company; capital, $15,000. Directors, Stanton Courter, John H. Tator and L. C. Holmes.

GREAT BEND, N. Y.—An electric light plant will be erected at Great Bend.

COLFAX, COLO.—The council has granted an electric light franchise to the Consolidated Electric Light Company of Denver.

ROCHESTER, N. Y.—The Proctor-Raymond Electric Company; capital, $20,000. Incorporators, Maurice Leyden, William O. Raymond, Charles M. Proctor and others, of Rochester.

RED BANK, N. J.—The Red Bank Electrical Illuminating Company has sold its electric light plant of the Tacoma Light and Water Company.

New Manufacturing Companies.

CHICAGO, ILL.—The Preston Chemical Electric Company; capital, $200,000. Incorporators, B. H. Ottinger, Harry W. Peck and Thomas Lesieur. The company will manufacture electrical appliances.

CHICAGO, ILL.—The Duplex Electric Trolley Manufacturing Company; capital, $100,000. Incorporators, Edward P. Hovey, James McTyner and P. L. Austin.

CAMDEN, N. J.—The Telephone Construction Company; capital, $50,000. Incorporators, Alfred A. Lowry, Charles B. Hewitt and George W. Valler.

American Telephone and Telegraph Company Increases its Capital.

A certificate of the increase of the capital stock of the American Telephone and Telegraph Company from $100,000 to $7,500,000 was filed with the Secretary of State at Albany, on April 7. The certificate shows that the amount of capital of the company actually paid in is $5,000,000, and the whole amount of its debts and liabilities is $1,476,942. The company's principal office is in New York city. The certificate is signed by David B. Parker and Melville Egleston, chairman and secretary of the stockholders meeting.

The Sunset Telephone and Telegraph Company has commenced laying all its telephone wires underground in Oakland, Cal. Excavating is now being done in the business portion of the city for that purpose.

A Fascinating Method of Education.

The great auditorium of Carnegie Music Hall was crowded on last Wednesday night, the usually large audience being increased by the presence of more than a thousand teachers from the public schools of this city, who took advantage of the special rates of admission offered to them by the directors of the "Urania" theatre, through the liberality of the management of Music Hall. Mr. Garrett P. Serviss, in his opening address, made some special remarks to the teachers, explaining the nature and aims of the "Urania" enterprise, and stating the desire of Mr. Carnegie and his associates to secure the co-operation of all those who are engaged in the practical work of education. He explained that the object of the "Urania" lectures and exhibition is two-fold: First, to furnish a very high order of entertainment, or of intellectual recreation, such as people of refined and cultivated tastes would desire, and secondly, to serve the cause of popular education. He said that there never had been such a combination of the magical powers of electricity with the ingenuity of stage craft as had been effected for the purpose of displaying the attractions and wonders of science—of science regarded as the twin sister of art. Astronomy, geology and the wonders of the face of the earth were the subjects thus far treated, but this was only the beginning of the development of this novel method of popularizing science. In order that no teacher in the public schools should be uninformed as to the character of the new enterprise, "Urania," in popular education, it had been arranged that during the remainder of this season all teachers could, upon application, obtain tickets of admission at special rates; and a similar provision had been made for the benefit of children in the public schools to whom the ordinary prices of admission might be a bar to their enjoyment of these novel and splendid spectacles of science.

Deeds were filed in Winona, Minn., last week by which the Winona General Electric Company absorbs the plants of the Winona City Railway Company and the Winona Electric Light Company, and both will be operated under the same management. The Winona General Electric Company has amended its articles of incorporation increasing the limit of its indebtedness from $250,000 to $500,000. The company will erect a large power house in that city this summer. The stock is owned and controlled by the Northwest General Electric Company.

The Mount Morris Electric Light Company, of New York, sued last week to recover $1,950 from the United States Horse and Cattle Show Society for light furnished during the exhibition at Manhattan Field, from May 9 to May 14, 1892. The defendant set up a counter claim for $2,000 damages, because the lighting was defective and it was difficult sometimes to determine what kind of quadrupeds were on exhibition. The plaintiffs admitted that the lighting was not perfect, but declared that it was the best that could be done with 92 lights in the cloudy and rainy weather. The case was finally decided by the jury awarding the plaintiff a verdict for $2,102.55.

RIDING ON AN ELECTRIC CAR.

[From *Judge*.]

Did you ever stand up in an electric car? | Going pretty fast? | Flying around a corner? | Curve around the market? | Then the other way? | Come to a sudden stop? | And get off looking like this?

KINDRED INTERESTS

The Berlin Iron Bridge Company, of East Berlin, Conn., have received the contract for the new rolling mill building from the New Haven Rolling Mill Company at New Haven, Conn.

The Holtzer-Cabot Electric Company, 92 Franklin street, Boston, has issued catalogue No. 20, giving illustrations of its standard dynamos, motors, indicators, controllers, switches, etc.

AUCTION SALE

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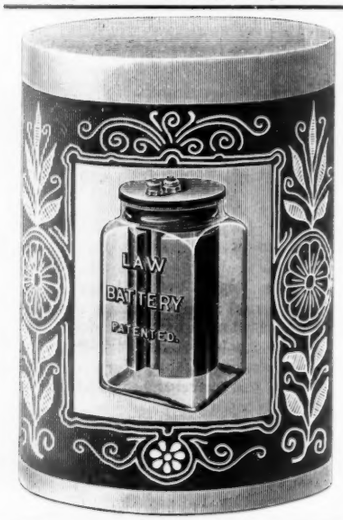

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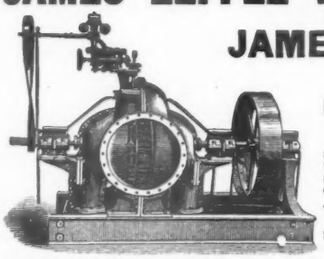

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THE AMERICAN BELL TELEPHONE COMPANY,
125 MILK STREET, - - - - BOSTON, MASS.

This company owns the Letters-Patent No. 186,787, granted to Alexander Graham Bell January 30th, 1877, the scope of which has been defined by the Supreme Court of the United States in the following terms:

"The patent itself is for the mechanical structure of an electric telephone to be used to produce the electrical action on which the first patent rests. The third claim is for the use in such instruments of a diaphragm, made of a plate of iron or steel, or other material capable of inductive action; the fifth, of a permanent magnet constructed as described with a coil upon the end or ends nearest the plate; the sixth, of a sounding box as described; the seventh, of a speaking or hearing tube as described for conveying the sounds; and the eighth, of a permanent magnet and plate combined. The claim is not for these several things in and of themselves, but for an electric telephone in the construction of which these things or any of them are used."

This company also owns Letters-Patent No. 463,569, granted to Emile Berliner November 17, 1891, for a combined telegraph and telephone, and controls Letters-Patent No. 474,231, granted to Thomas A. Edison May 3, 1892, for a speaking telegraph, which cover fundamental inventions and embrace all forms of microphone transmitters and of carbon telephones.